THE

# JOURNAL OF GAS LIGHTING.

## WATER SUPPLY, & SANITARY IMPROVEMENT.

VOL. XV. No. 363—18th YEAR.] LONDON, SEPTEMBER 18, 1866. [Subscription per Ann. { 15s. in Advance / 18s. Credit. ] Price 8d. Unstamped.

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CLASSES X. & XXXI.

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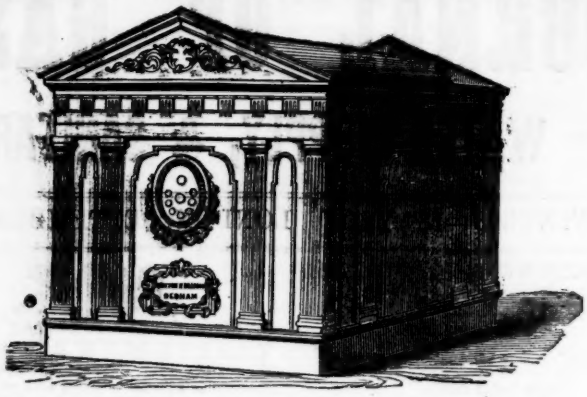

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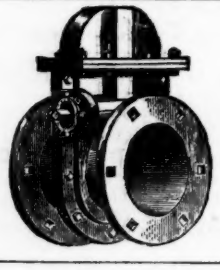

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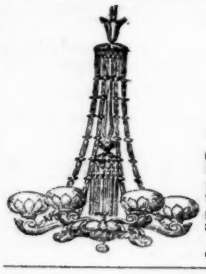

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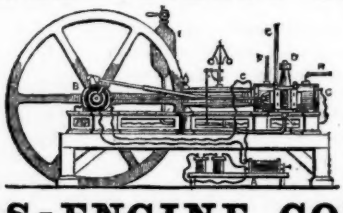

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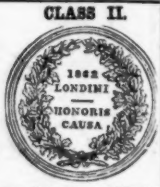


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It is worthy of remark, that the only two other Firms who receive Awards *both manufacture imitations of Thomas Glover's* Patent Dry Gas-Meter, and the reason given for these Awards is "*construction* and sound workmanship." Thomas Glover, therefore, claims that the *construction* of his Meter has obtained *three Awards from the Jury of the International Exhibition of* 1862; at the same time, *contrasting* the Award granted for his Meter by the words, "*For excellence of manufacture, as regards Dry-Meters.*"

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## CONTENTS.


PAGE

*Notes upon Passing Events:—*
The Act for the Improvement of the Navigation of the Upper Thames . . . 693
The Registrar-General on the Metropolitan Water Supply . . . 694
Dr. Frankland's Report on the East London Water-Works . . . 694
The Report and Minutes of Evidence on the Cattle Trade Inquiry 694

*Circular to Gas Companies:—*
The Accounts of the Paris Gas Company for 1865 . . . 695
Report of the Special Gas Committee to the Common Council on the Supply of Gas . . . 696
Dr. Letheby's Quarterly Report on the Chemical Quality of the Gas supplied in the City of London . . . 696
Election of Mr. Adair and Mr. Paull as Directors of the Chartered Gas Company . . . 696
The United General and Dublin Alliance and Consumers Gas Companies . . . 696
The Continental Gas and Water Company . . . 696

*Communicated Article:—*
On Defects in the Apparatus generally used for the Determination of Bisulphide of Carbon in Coal Gas, and Description of a New Apparatus for its Estimation, by A. G. Anderson, Esq. . . . 696

*Register of New Patents:—*
Penney, C. G.—Utilization of Waste Products resulting from the Combustion of Boghead Cannel and other Coals and Minerals . . . 698
Pocock, W. W.—Gas-Meters . . . 699
Tongue, J. G.—Obtaining Motive Power . . . 699
Bonneville, H. A.—Wrought-Iron Tubes . . . 699
Bonneville, H. A.—Lighting Apparatus . . . 699
Macintosh and Boggett—Gas-Pipes . . . 699
Willington, T. A. G.—Apparatus for Heating Conservatories, &c., by Gas . . . 699
Spencer, T.—Apparatus for Filtering Water and other Fluids . . . 699
Richards, W.—Apparatus for Measuring Liquids . . . 699
Lewis, J.—Meters for Measuring and Registering the Flow of Liquids 700
Clegg, R. D.—Pumps . . . 700
Giajola, C. E.—Privies and Commodes . . . 700
Shedlock, J. J.—Gas-Burners . . . 700
Abel, C. D.—Gas and Air Engines . . . 700
Leverson, M. R.—Gas for Illumination or for Obtaining Heat or Motive Power . . . 701
Marland, Smith, and Wells—Obtaining and Applying Artificial Heat 701
Fenby, J. B.—Pumps . . . 701
Young, J.—Distilling Coal, Shales, and other Substances . . . 701
Clay, W.—Economizing the Heat of Gas-Producers . . . 701
Fletcher, J.—Valves . . . 701
Applications for Letters Patent . . . 701
Grants of Provisional Protection . . . 701
Notices to Proceed . . . 701
Patents which have become Void . . . 702

*Miscellaneous News:—*
Dr. Letheby's Report on the Illuminating Power of the Gas supplied to the City of London during the Summer Quarter of 1866 . . . 702
Meeting of the United General Gas Company . . . 702
Meeting of the Ottoman Gas Company . . . 703
Meeting of the Newcastle and Gateshead Gas Company . . . 703
Report of the Paris Gas Company . . . 704
The London Water Supply . . . 705
Gas and Water Supply at Canterbury . . . 707
On the Natural and Artificial Production of the Diamond . . . 707
Return by the Metropolitan Association of Medical Officers of Health of the Composition and Quality of the Metropolitan Waters, in August . . . 708
Professor Frankland's Analysis of the Metropolitan Waters, in August 708
The Continental Gas and Water Company, Limited . . . 708
Ottoman Gas Company . . . 708
Drainage of Winchester . . . 708
Artesian Wells in Algeria . . . 708
*Share List of Metropolitan Gas Companies* . . . 708
The Bolton Water-Works . . . 709
*Price Current* . . . 709


## TO CORRESPONDENTS.

*No notice can be taken of anonymous communications. Whatever is intended for insertion, must be authenticated by the name and address of the writer; not necessarily for publication, but as a guarantee of good faith.*

A Member.—*We are informed that the issue of the report of the proceedings of the British Association of Gas Managers has been delayed by the preparation of the engravings illustrating the papers read, but that it is expected to be completed and issued by the end of the month.*

## NOTICES.


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# THE JOURNAL OF GAS LIGHTING,
## WATER SUPPLY, & SANITARY IMPROVEMENT.

*TUESDAY, SEPTEMBER* 18, 1866.


## Notes upon Passing Events.

The Thames Navigation Act is an instance of rapid, useful, despotic legislation, by a Parliament which ought to meet the approbation of those literary *doctrinaires* who are continually calling for a King Stork, without inquiry whether that king might not be, after all, mentally a Log. The upper Thames was suddenly discovered to be on the point of being blocked as a navigable river, insolvent as a commercial investment, and poisoned by sewage as a drinking source. With very little discussion all the old representative powers (which were so complicated as to be practically useless) were abolished; all the arrears of interest were sponged out; all the securities were postponed to the charges created by the new Bill for the purpose of the new improvements; a variety of claims to vested interests in tolls were swept away; and all the existing claims left to be arbitrated on in a very summary manner. The whole management of the upper Thames was handed over to the Conservators of the Lower Thames, who have themselves superseded the Corporation of London, with the addition of five other Conservators, one to be appointed by the Board, and four elected. It does not need any great acuteness to foresee that under this arrangement a very few persons, consisting of the most active members of the existing Board will manage the whole business. All the clauses of the Upper Navigation Acts, which amongst other things give certain persons a right to levy tolls, and bound them to keep certain locks in repair, or empowered them to draw down water for any purpose, are repealed. The new Conservators are to do everything, and receive everything that is to be paid in the shape of tolls. The Conservators are *to cause the surface of the Thames to be scavengered, so as to remove as far as possible all substances subject to putrefaction.* The five metropolitan water companies are each to pay a thousand pounds a year for the water they draw from the Thames. From the passing of the Act it becomes unlawful to drain sewage into the Thames. All existing sewerage works are to be discontinued at periods at the utmost not exceeding three years. Looking at the vigour with which the Conservators have set to work in the lower Thames, where they were hampered for want of funds, we may expect that within a reasonable time great reforms will be effected. Additional powers will be obtained, if needed. The Thames will be freed from sewage; obstructive locks and weirs will be cleared away, and those really useful put in good order. Some persons complain of the term of three years as being too long for the continuance of sewage drains from towns on the banks. But it must be remembered that this system of draining into the river was sanctioned either by specific Acts of Parliament, or under the powers of the old Board of Health. For years, under the highest official authority, all streams that lay conveniently have been polluted, in order to cleanse towns, and now there is a little impatience on the part of those whose councils caused the evil to cure in a few months the mistake of many years.

Mr. Bailey Denton has been writing to the papers on the subject of the Thames Navigation Bill, but we must confess that, with the exception of one very serious statement, we cannot find out what is either the meaning or object of Mr. Denton's letters. We know that Mr. Denton is a most able agricultural engineer, and that what he undertakes to do in drainage will be done thoroughly well; but he certainly has not the art, if he has the desire, of expressing what he means. We suspect that he is not satisfied with the last report on the Thames, and thinks another commission, with himself on it, would do better—and perhaps he is right. Still, it is a pity that when a man of special information and authority takes the trouble to write, he does not get some one to write for him, if he cannot write himself, so that the outside world may understand what he proposes and what he objects to. But when he asserts that a river flowing like the Thames, if once polluted by sewage, can never be again pure, we must take leave to think that he is more to be depended on as an agricultural engineer than as a chemist. To believe that when the sources

of pollution are cut off Nature has not the power to restore purity, is to set at defiance the experience of ages. Nature is more powerful than any chemist; if it were not so, the world would have been poisoned by sewage before the science of chemistry was dreamed of.

The condition of the water supply of London by the existing companies continues to be the subject of continual discussion, and of some useful and some utterly impracticable suggestions. In another column we give the report of Dr. Frankland on his survey of the East London Water-Works, and the remarks of the Registrar-General—or rather of Dr. Farr, for the Registrar-General—on that report. There is nothing to be objected to in Dr. Frankland's observations. He states that every facility was afforded him in performing his duty, and he shows how great have been the pains and how large the expenses incurred by the company to secure such a supply of pure water as was considered perfectly sufficient and satisfactory a very few years ago. Dr. Farr, on the other hand, is one of those characters who form a theory, and then cast about for facts to support it. He will not hear or see any evidence that does not suit him, and he acts as if he hated all those who cannot entirely agree with him. The insinuation contained in the words, "Mr. "Greaves alone can write the history of these eventful weeks," is positively malignant! The fact is, that works over which the water companies have no control have brought sewage to streams previously pure, and the water companies, whose supplies would be so much appreciated in almost all the great continental cities, are attacked because they did not foresee what would be the end of the Board of Health's universal water-closet system. It is rather curious that, in Mr. Hemans great scheme for providing London with water from the Cumberland Lakes, the amount of organic matter, as given by his chemist, Mr. Way, is as great as that found in London water, according to the analysis of Dr. Letheby and also of Dr. Frankland, for the month of August. The organic matter in grains per gallon is reported by Mr. Way to be in

| | |
|---|---|
| River Lowther . . . . . | 0·62 |
| Haweswater . . . . . | 0·62 |
| Ulleswater . . . . . | 0·35 |
| Thirlmere . . . . . | 0·77 |

As to the lime, magnesia, soda, and other alleged impurities, they merely add to its hardness, and are necessary constituents of potable water.

The evidence on the cattle trade has been printed, and contains much worthy of the attention of the consuming public. Amongst the more feasible recommendations in the report are the following:—"That public slaughter-houses "should be established for the compulsory use of carcase "butchers who deal wholesale in dead meat." From the evidence it is desirable that these slaughter-houses should be for hire by these butchers, so that they may have them under their own entire control, and so protect themselves from the robbery that seems common wherever animals are killed and butcher boys congregate. "That the careful inspection car-"ried out in the City of London be extended to all the meat "killed in the metropolis." "That a permanent department "of the Privy Council (query Board of Trade?) should be "appointed to keep up communications with the Board of "Customs and Her Majesty's consuls abroad, in order to have "accurate accounts as to the existence or otherwise of the "cattle plague, upon whose recommendations the Council "could act." "That the Privy Council shall declare any "country in which they believe the cattle plague to exist to "be an infected country, and to prohibit the importation "altogether of animals therefrom, or order importation only "to take place at certain ports, and that all animals so im-"ported shall be there and then slaughtered within four days "of their being landed." In reference to this we may observe that recent reports from Hungary and Galicia announce the serious outbreak of Rinderpest, which has always followed the march of armies. The evidence of all the persons called interested in the trade was very genuine—that is to say, genuinely selfish. The graziers take one view; the cattle salesmen another; the butchers agree with neither. Thus the cattle salesmen consider the market quotations given in the papers too high, and the butchers too low. Mr. Moseley, the traffic manager of the Great Eastern Railway, states that the receipts of that railway for cattle traffic are £100,000 a year more than any other railway, and yet, although the trade in dead meat is increasing, the new City Dead Meat Market will have no railway connexion with the Great Eastern. Norfolk, Suffolk, Cambridge, and Essex send the greatest number of fat cattle. Before the cattle plague broke out a large number of milch cows were brought from Rotterdam. Store sheep in large numbers are brought from Fakenham, Wells, and Dereham, to be fattened in Surrey, Sussex, and Kent. On the question of the comparative cost of transmitting beasts alive and dead, Mr. Moseley says: "The dead meat cost us nearly "double. The meat has to be packed in hampers, generally "provided by the company. It must then be loaded on the "trucks. When the meat arrives in London a large staff is "required to unload it"—perhaps two hundred men and clerks —"load it again on railway horse vans, convey it to Newgate "Market, where it has to be unloaded, pitched on the "stalls, and in the course of the day vans, horses, and "men must collect the return hampers and cloths to "be carried by rail to the stations whence they came. On the other hand, "the live animal walks in and out of the "truck and we have done with it." It seems that a new trade in cattle has sprung up at Antwerp, which was interrupted by the restrictions consequent on the cattle plague, and which will be renewed when they cease. At present the transit of all foreign cattle except French is prohibited in Belgium. But the accommodation at Antwerp has, since 1864, been found so good that large exportations, of sheep especially, were made from Magdeburg and all the south of Germany. They are landed at Harwich—one of the very numerous instances that a railway very unprofitable to its shareholders may be of extreme value to the country. Mr. Seymour Clarke, of the Great Northern, entirely confirms Mr. Moseley's evidence as to the additional cost of conveying dead meat. He pays 6s. a ton to a contractor to find cloths and hampers for dead meat. The year before the cattle plague began the Great Northern carried 20,000 tons of dead meat, or 63 tons for each working day, and as much as 160 tons a day when the live cattle trade stopped. "The consumption of meat in "London is considered to be about 200,000 tons a year." Mr. Seymour Clarke believes that it would be possible to feed London with dead meat all the year round; but in that opinion he differs with all the trade, wholesale and retail, and with other railway authorities. One morning in February the Great Northern had 93 tons of meat from 300 senders, in 1014 packages, the average weight being 1 cwt. 3 qrs. to some hundred salesmen. Heavy claims are laid against the company "for meat they cannot prove they have delivered." Some of these difficulties would be materially diminished by a dead meat market connected with all the railways. But Mr. Seymour Clarke, a high authority, is satisfied that there is not sufficient siding accommodation for the waggons of the Great Northern and the Great Western in the new market. The London and North-Western and Great Eastern have not secured any communication there. At present it takes on an average 1 hour and 18 minutes for each load to get from King's Cross to the Newgate Market. Mr. Clarke considers that to carry meat in trucks fitted up with hooks and shelves would not answer unless where a carcase butcher took a whole truck to himself. The railway cattle route from Aberdeen takes 36 hours. The steamboats take two days, and there is delay in landing.

Mr. J. C. Wall, the goods manager of the Bristol and Exeter Railway, gave an account of a successful experiment in selling dead meat direct to the consumers. The West of England Produce Company sent circulars to the graziers of the West of England when the traffic in live cattle was stopped, and invited them to send their dead animals to "a "good shed, fitted up as a carcase market, with sidings "running into it, into which meat-vans constructed for the "purpose ran." The railway company became (*temporarily*) responsible for proper accounts and remittances. The Devonshire and Somersetshire graziers answered the appeal. But the butchers of Bristol held a meeting and resolved to have nothing to do with the arrangement. The public were invited, came down in great numbers, and the meat was sold without difficulty. "Respectable people clubbed together; there was a great de-"mand. The stores were advertised, the people came at once, "and the graziers got very good prices; while, to the public, "the difference was in their favour to the extent of something "like 3d. per pound." The step was taken up, not as a speculation in meat, but to replace the traffic in live stock stopped by the Orders in Council. Our price for the carriage of dead meat has been reduced 40 per cent., and now it is about 60 per cent. higher than for live cattle. The system

was in active operation in May. The butchers have been obliged to lower their prices. Trains with meat and vegetables from Cornwall leave Plymouth at 2 p.m., Exeter at 5 p.m., and reach London at 4 a.m. We will next take the graziers views, for this meat question is really the greatest sanitary question of the day. Mr. Torr, who farms over 2000 acres on the dry part of Lincolnshire, is in favour of slaughtering live stock in the country, and increasing the dead meat market. He thinks that, in his thinly populated country, there would be no difficulty in disposing of the livers, lights, and heads to the labourers. He is not afraid of killing 20 sheep a week. He has supplied 30 dead sheep a week to butchers at Hull. It is odd to find a practical man like Mr. Torr quoting the opinion of a person like Mr. Donald, of St. James's Hall, whose boasting character would render him very unreliable as a witness, however excellent as a providitor. Mr. Torr would have a slaughter-house in every grazier-parish, near the railway-station. He is opposed to packing in bags, and would have the railway-carriage a slaughter-house on wheels, or rather a larder on wheels, where the fresh killed meat should cool. The greater part of this witness's evidence consists of loose opinions like the above, not sustained by more practical men; but here and there we get at points of importance. For instance: "The quantity of fat stock on the wolds of Lincoln-"shire (and in Yorkshire, too) was very low in the month of "June last. I have generally at this time about 120 grazing "steers, and I have now only 84. I have sold a good many "at about £28 each, which, if kept on, would have made "£40 in October." In November and December we shall know whether this sacrifice of store stock has been carried sufficiently far to affect the market price. The result of the restrictions on the cattle trade has been to largely increase the use of sheep. As store sheep can be had in any number from the Continent—crosses of English breeds—this will eventually make a great foreign trade. Mr. Torr states that his small sheep, "pure Leicesters, make a penny a pound "more than his larger crosses of Lincolns and Leicesters." Mr. Thomas Hudson, son of the celebrated John Hudson, of Castle Acre, in West Norfolk, is a witness of a different character. He and his father occupy over 2000 acres, chiefly arable, on which they graze, with turnips, great numbers of bullocks and sheep; they do not breed much, but buy from the West of England and Hampshire, at the Norwich and Peterborough fairs. Their stock is bought in autumn, fattened, and sold off before summer. The cattle are all bought from Scotland, the North of England, and Devonshire. Mr. Hudson does not agree with Mr. Torr. He prefers a live market and the competition of London butchers. "We have "no market for the offal of the beast in the country. I found a "loss of from £5 to £10 on each animal sent dead to London." The charges on live animals are 19s. each, including all expenses; the same dead costs from 35s. to 38s. Mr. Hudson, like all the farmers, would like to slaughter all foreign cattle, even from safe countries like Denmark and Spain, at the port of landing; but he approves of the small markets which Mr. Torr would put down. As to the retail price, some very striking evidence came from a carcase butcher and Common Councilman, Mr. Woodley. He says: "I think London, on an average, is the cheapest "place in the kingdom for meat. The prices of the different "parts of meat vary more in London than they do in the "country." The coarser parts of the animal are cheaper than in the country—"2d. per pound cheaper." The foreign meat gives that advantage—it is not so handsome, but it is good and useful, and the working classes have the advantage of consuming the coarser parts at a cheap rate. The eatable portions of offal are consumed within a mile of the slaughter-house. On the same subject Mr. Pulworth, a retail butcher, says: "The retail price all depends on how the meat is cut. "You may come to my shop, and ask for the middle of a "sirloin. There is a great deal at the top of a sirloin, and "you might say to me, 'I want that cut off.' Then you might "not want any suet at all. Trimmed in that way it would be "11d. a pound; but if you had it cut right away, suet and all, "then I should only charge you 9½d." The same witness puts the case for well-built, well-managed private slaughter-housss in such a manner as to show that a central slaughter-house would be a tax on the price of meat. "I want the "beast behind my house, in order to kill the moment the "weather turns, or when it is wanted. If I had to send a "couple of miles to kill a calf, I should often miss the sale of "a calf's head. Conceive the difficulty of getting meat home "in a sharp frost, and having to wait in a morning until the "blacksmith got up to rough (all) the butcher's horses; or "supposing we had to bring the meat home through a pouring "wet morning. Then there would be a lot of men—it is as "much as we can do to keep our men in order at home. Our "slaughter-houses are sweeter and cleaner than nine-tenths of "the dwellings of the poorer classes." It must be admitted that the evidence fairly justified the report; but we adhere to the opinion that the attempt to prevent by a branding system cattle from a fat market from being occasionally sold as stores will fail for want of machinery, and consequently we shall be subject to outbreaks of cattle plague from the central market, where foreign mix with home cattle.

## Circular to Gas Companies.

The reports presented at the annual general meetings of the Paris Gas Company are perhaps the most interesting and important documents of the kind which appear periodically in our pages. The directors of a company who possess an unexpired monopoly of 40 years, guaranteed by stringent regulations, and without the fear of professional agitators to misrepresent tneir conduct to the public, can admit their constituents into their confidence with regard to all the details of their undertaking; and in this respect, therefore, the reports of the Paris Gas Company present a marked contrast to those of the companies which have no guaranteed monopoly, and are periodically exposed to Flintoffism in its worst form. The progress of the Paris Gas Company has, indeed, been more remarkable than that of any other company in the annals of gas lighting. In 1855, when the amalgamation took place of the companies by which the city had been previously supplied, the consumption of gas was 1440 millions of cubic feet, and in 1865 it had increased to 4102 millions; of which quantity, however, 787 millions were consumed in the suburban districts recently annexed to the original limits within which the company were authorized to supply gas. The dividends on the share capital in the same ten years have increased from 8 to 21 per cent., and the undivided surplus of last year's operations amounted to £34,377 10s. The net profits of the year were £739,629 16s., which sum is more than the gross profits of the 13 London gas companies within the same period, though the gas-rentals of the latter exceeded that of the Paris Company in the proportion of £1,773,045 to £1,133,966. The proportion of capital employed to the gas produced was greatly in excess of that of the London companies, in consequence of the higher price of materials in France. The greater amount of profit realized by the Paris Company under such circumstances is no doubt attributable, in some measure, to the higher price charged for gas, which, according to the terms of their contract, is 6s. 8d. per 1000 feet to private consumers, while the public lamps are supplied at the rate of 3s. 4d.; the mean price of the whole for 1865 having been a fraction above 5s. 6d. Against that higher rate of charge, however, must be placed the higher municipal rates and taxes paid by the Paris Company, which amounted to the large sum of £103,047, the similar charges borne by the London companies being £47,951. The vicious system of charging less for gas supplied to the public lamps than to private consumers, which was forced on the Paris Company as a condition of granting their monopoly, has had the effect of restricting the consumption of gas in dwelling-houses; and the directors in their report remark on the comparatively small number of such consumers in Paris compared with most towns in England and in other countries. They refer to that source of demand as a prospective means of still further increasing their profits in future years, when it shall have been more largely developed. The extended use of Lenoir's gas-engine is referred to as having increased, and as tending still further to increase, the consumption of gas. The following tabular statement, which presents the nearest grouping that can be made of the respective items of the accounts of the London gas companies and of the Paris Company, shows at a glance the difference in the corresponding particulars of income and expenditure, and it points out forcibly the advantage which the Paris Company possess from the concentration of their operations:—

| Capital and Income. | London. | Paris. |
|---|---|---|
| Capital and borrowed moneys | £6,521,331 6 8 | £4,434,307 0 4 |
| Gas-rental | 1,773,045 13 4 | 1,133,966 16 7 |
| Meter-rents, &c. | 20,469 4 8 | 32,214 16 0 |
| Products | 398,128 4 4 | 261,276 10 0 |
| Old materials | 7,674 12 10 | Not separated. |
| Miscellaneous receipts | 12,288 11 5 | 10,400 10 0 |
| **Expenditure.** | | |
| Coals | £817,948 9 3 | £348,716 18 4 |
| Purifying materials | 17,023 11 3 | 5,576 16 5 |
| Supervision and labour | 225,821 7 3 | 79,003 13 0 |
| Repairs | 192,177 18 2 | 37,666 5 7 |
| Rents, rates, and taxes | 47,951 3 6 | 103,047 0 11 |
| Salaries | 38,050 8 10 | 21,121 16 7 |
| Collectors | 24,332 4 5 | 2,046 15 11 |
| Office expenses, &c. | 27,535 15 2 | 6,353 12 2 |
| Directors and auditors | 21,532 16 3 | 5,590 1 1 |
| Expenses of distribution | 99,372 12 0 | 56,388 19 7 |
| Restoring and replacing meters. | 25,520 17 8 | Not separated. |
| Law charges | 11,726 15 9 | 5,293 8 6 |
| Benefit and annuity fund | Nil. | 3,417 1 9 |
| Bad debts, &c. | 15,249 0 4 | Not stated. |
| Surveys and experiments | Nil. | 5,037 18 5 |
| Profits | 647,407 7 10 | 739,629 16 0 |

The difference between the two accounts is especially observable in the expenditure. The consumption of gas in London during the year 1865 was more than double the gas consumption of Paris, yet it is remarkable that the cost of coals in the latter city was considerably less than that proportion, notwithstanding the higher price of the material in Paris. This fact seems difficult to explain, unless it be assumed that the per centage of leakage is considerably less. The expenditure for purifying materials was also proportionately less than in London. But the most noticeable differences in the two accounts are in the items of expenditure for "supervision and "labour," "repairs," "collectors," "office expenses," and "directors and auditors;" the first part of which, in the Paris Company's accounts, does not amount to one-third that of the London companies, while some of the others are less than one-fourth the amount of the corresponding items of expenditure in the London accounts. The administrative economy with which the operations of the amalgamated Paris Gas Company are conducted is thus strikingly evident on the comparison of the two accounts, which point out clearly the advantages which may be gained by the concentration of management, whenever it is practicable, and the extreme folly of increasing the cost of supplying gas by the formation of competing companies.

The special Gas Committee of the Common Council of the City of London presented a long report at the last meeting of the Court, in which they detailed their operations in Parliament during the last session, and concluded by recommending that they should be empowered to continue their exertions to procure for the citizens an ample supply of cheap and good gas. We have not been able to obtain a copy of the report, which there appears to be an objection to make public, the object of concealment being, it must be conceived, to prevent adverse criticism before the consideration of the report at the meeting of the Court to be held on Thursday next. The efforts of the special committee have so far signally failed to make any impression on Parliament, and the rejection of the scheme of the Corporation to compete with the existing companies in the supply of gas met with a rebuff that might be thought sufficient to stop further proceedings in that direction. The committee must be dexterous special pleaders if they have advanced in their report reasons plausible enough for continuing the wasteful expenditure of the funds of the Corporation in endeavouring to obtain power to supply the City with gas.

Dr. Letheby's report of the chemical quality of the gas supplied in the City of London, shows that the average quantity of sulphur has been reduced by two of the companies which supply the City below the tolerated quantity of 20 grains in 100 cubic feet. The maximum quantity in the gas of the Great Central Company, however, was 26·71 grains and the minimum 14·79, the average being 21·65. The sulphur in the gas supplied from the Curtain Road station of the Chartered Company was at every testing under the tolerated quantity, and the gas of the City Company has averaged not more than 19·15 grains, though the maximum quantity reached 24·71 grains in 100 feet. It appears, therefore, that two of the City companies have nearly succeeded in overcoming the difficulty of freeing the gas they supply so far from sulphur as to place them beyond the reach of the law. The conclusion Dr. Letheby draws from the results of his testings during the summer months is, "that the quantity of sulphur can be kept down to "the parliamentary standard, and that the constant excess of "it in the Great Central gas, as shown in the successive quarterly reports for many years, is proof either that the company is incompetent to manufacture gas of proper purity, "or that it is unwilling to do so." The illuminating power of the gas supplied by the three companies was considerably above the standard of 12 candles. The fine imposed on the Newcastle and Gateshead Gas Company, for having supplied gas containing more sulphur than the small quantity tolerated by their Act, is to be appealed against, as was stated by the chairman at the recent annual meeting of the company. The appeal will most probably be founded on technical objections to the decision of the magistrates.

Mr. Adair, the member of Parliament for Ipswich, and Mr. Paull, the member for St. Ives, have, we understand, joined the board of directors of the Chartered Gas Company, to which their business habits and parliamentary influence cannot fail to give strength and confidence.

The United General Gas Company give up possession of their works in Dublin, Kingstown, and Bray to the Alliance Consumers Gas Company on the 29th inst., and from that date the operations of the former company will be limited to the city of Limerick. The Bill promoted by that company for reorganizing the Limerick establishment was so amended in the House of Lords, last session, that it became necessary to continue their present organization under their charter, which it was proposed to repeal. At the recent half-yearly meeting of the company it seemed to be generally admitted that it would be preposterous to continue their somewhat cumbrous management for the sake of the Limerick business alone. It was suggested by one of the directors that the company should try to extend their operations by the acquirement of gas-works in England, and he thought that in London or its vicinity works might be obtained so as to enable the company to retain their charter. The failure of the County and General Gas Company to carry such an operation to a successful issue should be sufficient warning to deter others from undertaking such a roving commission, and the power claimed under the charter of the company to break up the roadway of any town where they might contract for the public lighting, would, we conceive, prove to be illusory if attempted to be exerted.

Another company with a roving commission for establishing works in various parts of the world have got into trouble. A petition has been presented by a creditor for winding up the Continental Gas and Water Company; the consideration of it has, however, been adjourned, on the representation that an arrangement may probably be made for paying off the debt. The company have water-works at Arras and gas-works at the Mauritius, but they have found difficulty in raising the capital required for their completion, and allowed two verdicts to be taken against them for considerable sums at the last Bristol assizes.

## Communicated Article.

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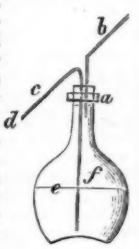
### ON DEFECTS IN THE APPARATUS GENERALLY USED FOR THE DETERMINATION OF BISULPHIDE OF CARBON IN COAL GAS, AND DESCRIPTION OF A NEW APPARATUS FOR ITS ESTIMATION.

By Alfred G. Anderson, Esq.,
Professor of Chemistry and Practical Chemistry in Queen's College, Birmingham, &c.

*(Continued from page 617.)*

One effect produced from the air being thus caused to circulate through the interstices of the pieces of pumice in this "Desulphurizer" before being admitted in contact with the burning jet *x* in the interior of the trumpet-tube, is, that the enclosed atmosphere is maintained throughout the experiment in a very still condition. The atmospheric air drawn in to replace the heated portions successively passing up the trumpet-tube into the condensers flows in continuously with complete regularity. The frequently remarked flickering of flame which will sometimes happen with the best description of single jet employed to burn the gas under the trumpet-tube when open to the external air, not unfrequently arising from such causes as the sudden opening or closing of a door or window, or the rapid movement of any one to and fro in the room, is, by its use, entirely prevented. In fact, we have in this arrangement the nearest possible approach, I think, to a great desideratum; the combustion of the gas in a vessel so far closed as to be entirely free from such external disturbing sources of inaccuracy. In all other construction of apparatus of this kind

hitherto described to accomplish this purpose, as I have now shown, we have had to contend with loss of sulphur from imperfect burning of the gas, and error from probable condensed sulphurous component parts of the atmosphere becoming retained in the receiving vessels. We shall see presently that the combustion of the gas in a quiet flowing current of air, controlled in its influx by its passage through the small lumps of pumice, affords results which, while almost wholly unanticipated by myself at the outset of these experiments, can only be explained upon the ground that when the gas is so burned its combustion is, if not quite, very nearly perfect. From the fact that, by the use of this additional pumice apparatus, the ascending column of air, heated inside the trumpet-tube by the jet of gas burning there, becomes so much reduced in velocity, I feared the possibility of some portions of the sulphurous fumes produced about, or a little above the burning jet *z* descending and subsequently getting absorbed, not only by the ammonia in the glass gutter *e f f' e'*, but also by the potassa soaked into the pumice lying against the perforated cylinder K *n* K *g*. Therefore, I have given particular attention to ascertaining exactly whether any source of error of this kind is incidental to the employment of this "Desulphurizer." When each experiment, of which I am presently going to give the full details, in which it had been put in action had terminated, the gutter-lute was emptied of its contents. To effect this, I may mention there is no necessity to remove the interior cylinder from the outer one. To do so after making each experiment would be a troublesome, and, owing to the use of potassa solution, a disagreeable task. Every trace of ammoniacal liquor remaining in the "gutter" can be readily removed with a small right-angle shaped glass syphon of one-eighth of an inch internal diameter in the following manner:—The syphon is filled with distilled water, and the shortest limb, in which the water is sustained by the pressure of the atmosphere when it is inverted by previously placing the finger over the other opening, is introduced beneath the fluid in the "gutter." Nearly every drop may be thus run off from it into any suitable vessel placed to receive it underneath the longest limb of the syphon by cautiously tilting it upon one side as its contents are removed; after which the syphon should be washed clean by the best adapted wash-bottle which can be obtained for this purpose. I have so often had occasion to refer to the employment of this washing-bottle, that it may be useful to many working at this subject, who are not entirely devoted to chemical pursuits, if I at once describe that which I prefer.




The washing-bottle best adapted for these manipulations is that figured upon the margin. A good soft cork (it is not quite safe to use india-rubber vulcanite ones where sulphur determinations are the subject of experiment, otherwise they are very convenient) is fitted to the mouth of the flask at *a*, which has two holes neatly perforated in it, through which are passed the two glass tubes, *b* and *c*. It will be seen that the tube *c* passes nearly to the bottom of the flask, and beneath the surface of the water at *e*. The tube *b* merely passes through the cork. The tube *c* is drawn out to a tolerably fine orifice at *d*. When the air occupying the space above the water *f* is compressed by blowing with the mouth down the tube *b*, the water *e* is propelled by the pressure up the tube *c*, and is then forced in a fine stream from the opening *d*, with an intensity varying with the force with which air is driven by the lungs into the tube *b*. When the flask is inverted a stream or pencil of water flows with a convenient rapidity from the tube *b*, which is thus supplied in a much more speedy manner than when blown from the smaller outlet *d*. Both of these jets of water are invaluable for rinsing the receivers, tubes, &c., to which I have made allusion in my papers; and if warm or hot water is wanted for such purposes, it is a matter of great simplicity to keep the flask (or a second stock one from which it may be replenished) standing upon a tripod over a suitable gas-flame until the water it contains has been raised by the heat to the required temperature.

Now, when the glass gutter has been rinsed by blowing warm water from the smaller orifice of this bottle upon its interior, and running it off twice by the cleaned syphon, it is always in my experience, quite clean, and ready to be charged with the ammonia to be employed as the seal in the succeeding experiment. It was in this way that I assured myself, at the conclusion of every experiment that I have hitherto made, of the certainty that no sulphurous compounds whatever become absorbed there whilst a combustion operation is in progress. That is to say, I removed repeatedly the liquor from the glass gutter at the end of the process, passed chlorine through it, boiled, and mixed it with a little chloride of barium. As a result of every trial, I never obtained the slightest turbidity, proving the entire freedom of the liquid from any trace of sulphur compounds.* This, then, being the case, it may with complete certainty be deemed as quite conclusive that no sulphurous particles can get absorbed by the potassa soaked pumice through their descending (or diffusing) down the contracted opening *f f'* into the perforated chamber K K *n g*, and so coming into contact with these packed outside it.

It is a safe precaution, however, never to omit adding the contents (and washings) of the "gutter" to the products of the gas burning of the receivers, &c., when an experiment is finished. If this be not done, they must be separately tested, as I have described, for sulphuric acid. All this is necessary for the following reasons:—An operator not sufficiently accustomed to the use of the pumice apparatus and the "single" jet, might possibly burn the gas with too small a flame. This would cause some part of the products of combustion, instead of being wholly carried into the condensers, to attach themselves to the sides of the trumpet-tube, because of its not being kept hot enough, which is sometimes the case when 2½ cubic feet occupy more than six hours to burn. If we do not require more than 5½ hours time to consume 2½ cubic feet, we avoid this condensation inside the trumpet-tube. This is of no importance whatever when the trumpet-tube dips into the gutter, and we take care to subsequently add its contents to the other products, for the drops of fluid, as they trickle down the first, run into and are received by the last. But if there be no gutter placed under the trumpet-tube, as in the open arrangement, then it is not an unfrequent occurrence for these drops to fall upon the table and become a loss in the analysis. Of course it is an important loss from the fact that drops of fluid in flowing down the interior of the upright tube wash down no inconsiderable portion of sulphite and sulphate of ammonium, which always collects there in notable quantity.*

When the pumice apparatus has been used so many times that it is considered necessary to again soak the fragments of pumice in fresh potash, we may further save ourselves some loss of time and a little unnecessary trouble by proceeding as follows:—It will be recollected that an outlet has been described as provided near the bottom of the outside vessel, in the inside of which these pieces of pumice are placed. It is shown in the drawing at page 617, at *b*. Now when the spaces *a* K *n m* and *a* "K *g m*," which extend around the inside perforated cylinder and the outer one, are filled with the pumice fragments, the solution of potassa prepared for the soaking process is to be frequently poured over these, so as to bring it into contact as much as can be with every piece of pumice in the vessel. After the solution has drained to the bottom, it is poured out from the opening *b*, and when this has been corked tightly it is again thrown with care upon the pumice: drawn off, and the same procedure repeated until it is quite certain all the pumice is well saturated by the potassa. It is important that the utmost caution be exercised lest, in putting the potassa solution over the pumice, some of it is by chance conveyed into the glass gutter. If any by an accident of this kind fell there, as the potassa used in this case would undoubtedly contain a considerable quantity of sulphuric acid, it is evident a serious cause of error would occur in the next analysis in which the gutter would again be used.

The experiments made to compare the results obtained by burning precisely similar volumes of a selected bulk of gas, first, with either the "single" or the "Leslie" burner, over ammonia, with free access of common air, and secondly, with the jets enclosed by the "Desulphurizer," are now to be described. It should be mentioned, however, in the first place, that the samples of gas taken in each case were stored in the gasholders A and B (p. 569, vol. xiv.) in the following manner:—The inlet D was closely plugged by a good cork. The tap C was then opened, and water from the tap H' was conveyed by a flexible tube to it until it overflowed there. Then the tap C was shut off, and joined to a supply stop-cock of the company's main. When the cork by which the opening D had been closed was removed, after that opening had been covered with water by pouring it into the small cistern E, the gasholder A remained filled with water supported by the pressure of the atmosphere. When, again, the tap C and the stop-cock of the company's main were cautiously partially opened, all the water which ran away through the opening *e* was replaced by gas. In this way gasholders may be very conveniently and expeditiously filled with gas from a company's main.

The first experiments of comparison were made with the contents of gasholder A filled from the company's main as above described; 2½ feet were transferred from it to the gasometer F (vol. xiv., pp. 569 and 658), and burned with the same "single" jet used in all the experiments of comparison with the "Leslie" jet detailed at page 616, vol. xv. The same apparatus, indeed, was employed in this case as in those instances. The second equal bulk of this gas was, in turn, burned inside the "Desulphurizer" on the afternoon of the same day, so soon as the apparatus used in the first combustion could be washed clean and set up ready for the experiment to be commenced. It had been previously arranged, by taking care that the "single" jet, which, as I have above observed, has been constantly in requisition in all my experiments, should be capable of transfer at any time from above the funnel figured at page 658, vol. xiv., to the inside upright pipe of the "Desulphurizer," page 617, vol. xv. As the connecting-screw threads of both of these vessels were alike, it could be placed in connexion with either in a few moments.

In the following table the results of these two combustions are appended:—

* A few days ago, having occasion to estimate the sulphur in the apparatus as drawn by Dr. Letheby for the *Chemical News*, after 5 feet of gas had been burned, I tested the ammonia of the bottle placed under the funnel and Leslie burner for sulphuric acid in a like manner. I did not find a trace there.

* See page 659, vol. xiv.

*Table showing the Results obtained by burning two equal measured bulks of Coal Gas. They were both burned with the same Jet, but in one case the new apparatus, called the "Desulphurizer," was used in addition. All other conditions except this (including oxidation by chlorine and employment of the same vessels) were precisely similar.*

| Experiments. | Quantity of Gas analyzed. | Description of Burner used. | Whether "Desulphurizer" was used or not. | Weight of Sulphate of Barium obtained. | Amount of Sulphur calculated for 100 Cubic Feet. |
|---|---|---|---|---|---|
| V | 2½ c. feet .. | Single jet .. | No .. | 1·61 gr. .. | 8·84 gr. |
| W | 2½ c. feet .. | Same jet .. | Yes .. | 2·21 gr. .. | 12·12 gr. |

Then the difference between the numbers obtained by the use of the "single" jet, 8·84, and those furnished by the addition of the "Desulpurizer," 12·12, is 3·28; and

8·84 : 3·28 :: 100 : 37·1 per cent.

From these first experiments of comparison, it appears that more than one-third of sulphur increase is capable of determination by the addition of the "Desulphurizer" apparatus. This result was so unlooked for, that a number of other experiments in confirmation were forthwith put in hand.

Both the gasholders A and B were (vol. xiv., p. 569) for this purpose simultaneously filled with gas from the company's main. Three experiments (following in immediate succession) were immediately commenced. The results are tabulated underneath:—

*Table showing the Results obtained by burning three equal measured bulks of Coal Gas. All three were burned with the same Jet, but in two instances the new apparatus, called the "Desulphurizer," was employed in addition. All other conditions except this (including oxidation by chlorine, the use of the same condensers, &c.) were precisely similar.*

| Experiments. | Quantity of Gas analyzed. | Description of Burner used. | Whether "Desulphurizer" was used or not. | Weight of Sulphate of Barium obtained. | Quantity of Sulphur calculated for 100 Cubic Feet. |
|---|---|---|---|---|---|
| X | 2½ c. feet .. | Single jet .. | No .. | 2·10 gr. .. | 11·52 gr. |
| Y | 2½ c. feet .. | Same jet .. | Yes .. | 2·69 gr. .. | 14·76 gr. |
| Z | 2½ c. feet .. | Same jet .. | Yes .. | 2·70 gr. .. | 14·80 gr. |

The mean of the last two experiments are the numbers 14·78 grains. The difference between these, and the numbers obtained without the addition of the "Desulphurizer," is 3·26 grains. Then—

11·52 : 3·26 : : 100 : 28·3

which calculation demonstrates that a loss of sulphur to the extent of *twenty-eight and one-third per cent.* arose through employing the "single" jet to burn the gas without applying that jet for that purpose in conjuction with the "Desulphurizer."

There is such a close coincidence in the amounts of sulphate of barium obtained in the experiments Y and Z—which it will be seen by a reference to the table are the two made in which the "Desulphurizer" was brought into requisition—that one might be almost inclined to consider that by such system of proceeding we have at length arrived at a method by which the whole of the sulphur existing in a bulk of coal gas would be susceptible of exact determination. More than a year ago I found that a great degree of uniformity attended determinations by the "single" jet, simply, as generally done, placed over the bottle of ammonia, provided all the conditions under which the different experiments were made were preserved in close uniformity. A reference to some experiments of mine made in August, 1865, and published at page 658, vol. xiv., demonstrates this in a singular manner. Four experiments made at that time to ascertain the degree of accuracy attainable by using the "single" jet to burn a volume of gas divided into four equal bulks gave, as there recorded, the respective quantities of sulphur at 13·11, 12·51, 12·34, and 12·64, each being calculated to correspond to 100 cubic feet of gas. As we now know it to be conclusively established that it is quite impossible to determine *all* the sulphur in a coal gas by using the "single" jet to burn it in the manner there described, notwithstanding the very close agreement obtained in the four experiments given above, it must not be assumed for one moment either that the close approximation between the numbers 14·76 and 14·80 given by the pumice apparatus addition any further contribute towards proving this possibility.

It is a curious fact, however, which may be deduced as a perfectly safe inference from the results of these six experiments, assuming, as most probable, that in not one of them did I succeed in arresting the *whole* of the sulphur, that the quantity of sulphur lost in these cases, provided the conditions under which the experiments are conducted possess very great uniformity, is proportionate *to an almost exact degree*. I must confess, however, that it is anything but easy to understand how this should necessarily always happen in a coincident rate in several analyses, when methods corresponding to an average manner of proceeding are followed, in *all* of which we cannot fail to ensure some loss from defects inseparable from the system. Are there *some* sulphur constituents present in coal gas which resist with great obstinacy, by even slow yet very complete burning in atmospheric air, oxidation into sulphurous acid? I have records of experiments in which "Leslie's" burner was resorted to for the estimation of the sulphur in the usual manner in a bulk of gas divided into two equal portions, where, as might be expected from its usual unsteady action, this close average of estimation was altogether wanting. In other instances, however, where, notwithstanding that every care is exercised to ensure very complete combustion, and subsequent good condensation, that the loss should occur in a *ratio so constant* is a fact not a little puzzling.

The numbers we obtain from the comparative experiments detailed above, made with the "single" jet and the "Desulphurizer," exhibit an average of increase in the quantity of sulphur arrested and determined by the addition of the latter of 32·7 per cent., being respectively, in the first set of analyses, 37·1 per cent., and in the second 28·3 per cent. It is worthy, perhaps, of remark that the gas of the second series of experiments contained the most sulphur, although the loss shown is less in degree. I have demonstrated at page 617, vol. xiv., that we incur an average of 34 *per cent. of loss* in all estimations of sulphur in coal gas, when we do not substitute the "single" jet for the "Leslie" burner in burning it as usually practised under the trumpet-tube open to the atmosphere. Doubtless a good and reliable approximative result may then be deduced, to show the advantage to be derived from replacing the usual arrangement adopted in the use of the "Leslie" burner by the "single" jet and "Desulphurizer," if we take the sum total of the following numbers:—

| | |
|---|---|
| Superiority of "single" jet over "Leslie" burner, demonstrated by experiments to be ..... | 34 per cent. |
| Superiority of "desulphurizing" vessel over the "single" jet, also demonstrated by experiments to be ..... | 32 per cent. |
| These considerations prove that .... | 66 per cent. |

of the sulphurous ingredients of coal gas escape estimation in analyses when the "Leslie" jet is employed as commonly applied, instead of the improved arrangement to which I have drawn attention. Let us see how this calculation is borne out, by the two experiments given in the following table.

*Table showing the Results obtained by burning two equal measured bulks of Coal Gas; one of these being burned with the "Leslie" Burner, the other with the "Single" Jet, with the addition of the "Desulphurizing" Vessel.*

| Experiments. | Quantity of Gas analyzed. | Description of Burner. | Weight of Sulphate of Barium obtained. | Amount of Sulphur calculated for 100 Cubic Feet. |
|---|---|---|---|---|
| A .. | 2½ c. feet .... | Leslie burner .... | 1·50 .... | 8·24 gr. |
| B .. | 2½ c. feet .. | Single jet and Desulphurizer .. | 2·61 .... | 14·32 gr. |

Then the difference between 8·24 and 14·32 is 6·08. Further, 8·24 : 6·08 :: 100 : 73·78 per cent. loss incurred from the employment of the "Leslie" burner in the place of the "single" jet and the "desulphurizing" vessel.

If we now place these results in juxtaposition with the following experiments and remarks of M. Ellissen (vol. xiii., p. 713) we shall see that by the use of this "Desulphurizer" there is some reason to believe we really do succeed in burning and retaining *nearly* all the sulphur of the gas submitted to the action of the apparatus.

M. Ellissen says, "A last method of determining the amount of sulphur in gas—a method which is perhaps the most reasonable and most exact—consists in oxidizing entirely the sulphur by chlorine." He thus obtained, by the "Leslie" burner, 5·65 of sulphur; by the "oxidation" process, 10·13 of sulphur.

Then the difference between 5·65 and 10·13 is 4·48; and

5·65 : 4·48 : : 100 : 79·2

per cent. loss through the use of the "Leslie" burner.

Since becoming aware of the high determinations effected in the manner I have now described by my new adaptation, I have sought to compare them with analyses in which no sulphur present in the gas should escape estimation. My investigations upon this part of the subject, I can only now say, leave me in doubt as to whether this has yet been successfully accomplished by any experimenter. The account of them must be deferred for another communication.

(*To be continued.*)

## Register of New Patents.

200.—CHARLES GREGORY PENNEY, of Greenwich, in the co. of Kent, for "*Improvements in the treatment and utilization of certain waste products resulting from the combustion of Boghead, cannel, and other coals and minerals, and for the treatment of China clay and other analogous substances.*" Provisional protection only obtained. Dated Jan. 22, 1866.

This invention relates to the utilization of the coke and ash resulting from the combustion of Boghead or Torbane Hill coal or mineral, cannel, and other coal possessing analogous properties, and also bituminous shale and minerals, such coke and ash having been hitherto partially or entirely waste or useless products. The coke formed by the combustion of any of the substances above mentioned is burned in a furnace constructed in a suitable manner, in accordance with principles well understood, the heat so obtained being used for any desired purpose to which it is applicable.

The result of such last-mentioned process of combustion will be that, after the carbon has been thereby removed, a residuum or compound ash, consisting mainly of silica and alumina, is left, and which is capable of being applied to various useful purposes. The said ash may be digested, boiled, or heated in sulphuric, hydrochloric, or other mineral acid, or in acetic acid or in any suitable mixture of such acids. If the ash be treated

with sulphuric acid the result will be sulphate of alumina, which having been evaporated will constitute sulphate of alumina, or cake alum, or the solution may be converted into common alum by mixture with potassia or ammoniacal salts, and then concentrated by the well-known methods. If hydrochloric acid be used, the result will be chloride of alumina; and if acetic acid be employed, acetate of alumina will be produced, either of which salts may be used for any of the purposes to which they are applicable. The insoluble residue from any of the before-named processes can be used with particular advantage for the manufacture of silicate of soda or potass, on account of its finely divided and readily soluble state, the usual methods of manufacture being employed. Such insoluble residue can also be used for the manufacture of glass, or for any purpose to which pure silicate is applicable. If it is preferred, silicates or aluminates of the alkalies may be prepared by furnacing the coke, in the first instance with the alkali, without first removing the carbon. The ash so obtained from the combustion of the coke as before mentioned, or either of its constituents, can be used for loading paper or cloths, and also for the purpose of enamelling, and as pigments, and also for polishing; and, if desired, the colour thereof can be improved by means of acids either gaseous or liquid, or the same may be bleached by means of the ordinary agents and processes applicable to such purposes. The refuse silica from China clay and other substances of analogous character can also be utilized by adopting the above-mentioned processes.

274.—William Willmer Pocock, of Craven Street, Westminster, architect, for "*Improvements in gas-meters.*" Patent dated Jan. 27, 1866.

This invention consists in constructing gas-meters as hereafter described. Inside an outer cylinder or case, closed at all parts, except to inlet and outlet pipes, is fitted another concentric cylinder, so that a space is left between the two cylinders. The inner cylinder is soldered or connected at the bottom to the end of the outer cylinder, while its upper end, which reaches to about the middle of the height of the outer cylinder, is open. Liquid is admitted into the space between the cylinders. Over the inner cylinder and within the outer cylinder is a third cylinder acting as a piston; it is of larger diameter than the inner cylinder, is closed at the top and open at the bottom, and is free to move up and down in the space before mentioned. The space between the top of this third cylinder and the outer cylinder forms one gas-chamber, while the space within and below the third cylinder forms a second gas-chamber, the two chambers being hermetically sealed from each other by the liquid in the liquid space. The gas is allowed to enter into each of these chambers alternately, and its pressure causes the moveable cylinder alternately to rise and fall, the gas contained in the chambers being alternately supplied to the pipes. The number of up and down motions of the moveable cylinder so registered and the quantity of gas passed through the meter can therefore be ascertained. The moveable cylinder has connected thereto a cord or string passing through the top of the outer cylinder, and over one or more wheels to a counter-weight, to one of which wheels the registering apparatus may be connected. To prevent escape of gas through the aperture in the outer cylinder through which this cord passes, a tube is carried down from this aperture into another tube in the moveable cylinder containing liquid to form a liquid seal. Instead of cylinders, any other convenient shaped cases may be employed. The meter is fitted with any suitable arrangement for admitting the gas alternately into the two chambers.

291.—John Garrett Tongue, of the firm of Tongue and Birkbeck, engineers, of 34, Southampton Buildings, Chancery Lane, London, for "*Improvements in obtaining motive power either giving or not giving light.*" A communication. Provisional protection only obtained. Dated Jan. 30, 1866.

This moving power can be either productive of light or not, and is obtained either by the agency of hot air or by steam; it will also serve to dry or superheat steam, to increase its power without increasing the expense of fuel or augmenting the pressure on the boiler. The system is applicable to steam-ships, railways, and generally to all purposes where mechanical power is required. The summary of the principles which constitute this improved motive power may be thus stated:—First, to take from the atmosphere air as cold as possible; second, to compress it by force-pumps into a close space divided by fillets or thin metal plates; third, to heat it by the most economical means that science has rendered available; fourth, to conduct it thus heated—that is to say, expanded—into conducting-tubes to one or more working cylinders; fifth, to utilize the heat at its exit from the cylinders, first, by making it exclusively feed the furnace—that is to say, to make it furnish the quantity of air required by the working, and for the proper combustion of the gas—and then, in utilizing the rest according to the requirements of the purpose to which it is applied.

305.—Henri Adrien Bonneville, of 24, Rue du Mont Thabor, Paris, and 38, Porchester Terrace, Bayswater, London, for "*Improvements in the manufacture of wrought-iron tubes, applicable to different purposes.*" A communication. Patent dated Jan. 31, 1866.

This invention relates to certain improvements in the manufacture of wrought-iron tubes or pieces of a cylindrical or prismatic form, bored or pierced with a central opening. It consists in making the same from turnings, shavings, or other small pieces of iron formed by turning, punching, or planing iron. To make an iron tube or gun-barrel, the material is introduced into a cylindrical or prismatic mould, provided with a central fixed mandril for forming the hole or bore. A hollow piston is used for compressing the material by means of hydraulic or other power, so as to agglomerate and give it the form of the piece required. The tube thus partially agglomerated is next heated, and soldered on the mandril, either by the means of a steam-hammer, by hand, or even by the use of rolls, and afterwards, if necessary, drawn out to the required thickness. When intended for nuts, the tube may be compressed and soldered piece by piece, but it is preferred to form a tube of a certain length at a time. These tubes are soldered on the mandril in a stamping tool, or in the grooves of a flatting mill, the pieces assuming the hexagonal or square form according to the kind of nuts required. The tubes thus soldered are cut into slices, by incisions perpendicular to the axis, done on a lathe or with a saw. Each slice will form a nut, which, if cut on the lathe, will have the advantage of having both sides rounded and chamfered. By the same process, and with the same materials, all sorts of iron pieces, punched or not with one or several holes, may be obtained. Prior to the cutting of the nuts and holes, and whilst the soldered tubes are whole, it would be very easy, seasonable, and inexpensive, to size them by planing or grinding, so as to obtain nuts worked and finished on every side. The claim is for applying turnings or shavings of wrought iron to the manufacture by compression, hammering, or rolling, of pieces of wrought iron, and particularly those having a cylindrical or prismatic exterior form, punched with one or several holes, as described.

306.—Henri Adrien Bonneville, of 24, Rue du Mont Thabor, Paris, and 38, Porchester Terrace, Bayswater, London, for "*Improvements in lighting apparatus.*" A communication. Provisional protection only obtained. Dated Jan. 31, 1866.

This invention relates to the application of oxygen to lamps for increasing their lighting power. This is done by forming the lamp with a cavity for containing oxygen, which flows through the tube serving ordinarily for the passage of the air. The upper end of this tube is partially closed by a plug bored with holes, through which the oxygen is spread over the burning wick or flame, thereby increasing its brilliancy. In cases where this is practicable, a tube, communicating with a reservoir of oxygen, may be used instead of the cavity in the lamp.

316.—John Macintosh, of North Bank, Regent's Park, London, and William Boggett, of Lindsey House, Chelsea, for "*Improvements in gas-pipes.*" Provisional protection only obtained. Dated Feb. 1, 1866.

The object of this invention is the prevention of leakage of gas, and in order to effect this object it is proposed, in the first place, to substitute pipes made of glass for the cast-iron pipes now in use, or to insert glass cylinders into them by way of lining; or they may be coated internally with liquid glass. Another method is to coat the iron pipes with collodion, either by itself or combined with glue or other gelatinous or albuminous substances, in conjunction (when requisite) with canvas, paper, or other textile or fibrous material. The object can also be obtained by the use of shellac, or a compound of shellac known as marine glue; or the interior of the pipes may be tinned or coated with enamel.

346.—Theophilus Alfred Gilbert Willington, of Rose Hill, Handsworth, Staffordshire, for "*Improvements in apparatus for heating conservatories, apartments, or boilers by means of gas.*" Patent dated Feb. 3, 1866.

Two or more chambers or stoves are employed, which are internally heated by gas-jets. These heating-stoves or chambers are connected together by a heating-pipe or tube conducted round the place which is required to be heated. One of the chambers is made larger than the other, and is heated with a greater number of gas-jets. This, for distinction, may be termed the inlet heating-chamber, as it is connected, by means of the inlet-pipe, with the open air. To the inlet heating-chamber is attached one end of the heating-pipe or tube, and when the apparatus is used for heating conservatories or other places of moderate size, there is fixed at or near the other end of the heating-pipe a second and smaller heating-chamber or stove, in which a smaller number of gas-jets are burnt, and which may be called the outlet heating-chamber, as it is connected with the open air by an outlet-pipe. The combustion of the gas in the smaller or outlet-chamber causes it to act as an exhaust, and to draw a current of heated air through the conducting-pipe or tube from the larger heating chamber. The latter is constantly delivering volumes of heated air, which are urged and pass through the tube, and are drawn into the outlet heating-chamber, and then passed on into the open air.

356.—Thomas Spencer, of Euston Square, in the co. of Middlesex, chemical engineer, for "*Improvements in the mode of and apparatus for filtering water and other fluids.*" Patent dated Feb. 5, 1866.

These improvements relate to the construction of apparatus, the object of which is to combine the advantage of both the upward and downward systems of filtration, and at the same time dispense with the immense mass of material required for the ordinary downward system. The apparatus consists of an earthenware tile of a proportionate thickness, or of a flag, with a hole or perforation in the centre, upon which is fastened a hat-shaped piece of earthenware, or other suitable material, containing a series of holes or perforations near its crown, the size and number of which holes are regulated by the quantity of water or other fluid required to be filtered in a given time. This hat-shaped piece is fastened over the perforation in the tile with Portland or other suitable cement. The upper portion of this hat-shaped piece has a cover or jacket of earthenware, or other suitable material, which is made to rest on the upper side of its flat rim. The space between the hat-shaped piece and the jacket is filled with fine gravel, but not so much so as to allow any of its granules to pass through the holes or perforations. The apparatus thus arranged is then to be placed at given intervals on the covered drain of a filtering bed or tank, to be constructed at the bottom or lower level of the same, the tile part of the arrangement being substituted for and made to serve as one of the covering tiles of the said drain.

372.—William Richards, of 7, Regina Road, Holloway, in the co. of Middlesex, engineer, for "*Improvements in means or apparatus for measuring liquids.*" Patent dated Feb. 7, 1866.

These improvements relate, firstly, to means or apparatus for measuring liquids at a low pressure. Secondly, they relate to means or apparatus for measuring liquids at a high pressure. In both cases a vessel is employed which may be similar to the revolving wheel of a wet gas-meter, with a series of measuring compartments, but having a cylindrical chamber in its centre. The inlet-passages to the respective measuring compartments are shorter than the outlet-passages from them, so that each chamber in rotation becomes filled. This vessel or wheel, with its series of measuring compartments, is attached to an axle, one end of which is hollow, to communicate with passages to the respective measuring compartments. This measuring-wheel is placed in a suitable case having a chamber attached to it to receive the liquid to be measured. In this receiving-chamber is placed a lever-float fixed to an equilibrium-valve, to regulate the supply of the liquid entering the apparatus. The hollow

end of the axle passes into this receiving-chamber, and is made water-tight by means of a stuffing-box or gland to separate the unmeasured from the measured liquid.

The action of the apparatus is this—the liquid entering the chamber containing the float passes into the hollow shaft or axle, and thence into one of the measuring compartments of the wheel until that compartment becomes full. The liquid then passes into a second measuring compartment, when, by the weight of the liquid entering this second compartment, that in the first is displaced, and so on continuously, causing the wheel to revolve. The measured liquid passes off at the lower part of the case. A worm on the shaft, by means of suitable gearing, actuates an index to show the number of revolutions or the quantity of liquid passed, as is well understood in respect of meters for measuring gas. The action of this apparatus may be reversed by causing the liquid to enter at the lower part, outside the wheel, and so pass off through the hollow axle.

For measuring liquids at high pressure, according to the second part of the invention, a similar measuring-wheel is employed and an air-tight case as that mentioned, but to this is added, at the lower part of the case, and in direct communication therewith, another vessel or air-tight chamber, or the two parts of the air-tight chamber may form one and the same vessel. In this apparatus, when the liquid flows from the measuring-wheel, it descends into the lower air-chamber, or the lower part of the combined chamber, and so compresses the air in the combined case or chamber as to produce sufficient force to expel the measured liquid the desired height. The size of the lower air-tight chamber, or the lower part of the combined chamber, must be sufficient to permit of compression of air therein adapted to the pressure required to expel the liquid to the height of delivery. In some instances it may be more convenient to limit the dimensions of the air-vessel, so as to deliver the liquid at a given height without regard to the inlet pressure, in which case a float is employed to actuate an equilibrium-valve and regulate the supply.

The claims are:—

1. The adaptation or combination of means or apparatus for measuring liquids whereby the liquid to be measured is conducted from a receiving-chamber or inlet-passage to the measuring compartments, and whereby the capacity of the compartments of a revolving-wheel or vessel becomes the measure of the liquid passing through the apparatus, substantially as described; also forming the outlet-passages from the respective measuring compartments longer than the inlet-passages to them, acting in manner and for the purpose substantially as described.

2. The application of an air-chamber in connexion with apparatus for measuring liquids, to facilitate the delivery to situations above the level of such measuring apparatus substantially as described.

375.—Joseph Lewis, of Manchester, in the co. of Lancaster, engineer, for "*Improvements in meters for measuring and registering the flow of liquids, part of which improvements is also applicable to regulating the flow of steam.*" Provisional protection only obtained. Dated Feb. 7, 1866.

This invention in meters relates firstly to that construction known as diaphragm meters. This diaphragm is formed of india-rubber, or other flexible material which will bear stretching as the fluid presses against it. On each side, and connected with it, are placed curved shields, which it is preferred should almost touch the circumference of the cylinder. To these shields the usual rods, which may be called piston-rods, are attached, and during the working the diaphragm laps thereon.

Secondly, the invention refers to valves for meters. These improved valves consist of a plug working in a socket. Through this plug an aperture is formed at each end for the fluid to pass, and between these two apertures a smaller diameter of the plug constitutes another fluid-way. At right angles to each of the aforesaid apertures the plug is formed flat, or is hollowed to allow access of pressure, and establish an equilibrium. This part of the invention is applicable to valves for regulating the flow of steam.

Third, the invention relates to a spring and other apparatus, by which the necessary change of the valves of meters is effected. For this purpose, a spring is employed which becomes charged by the motion of the piston-rod. This spring, in process of being charged, presses against a lever, which is prevented from turning by a catch. When, however, the piston-rod has moved through a determined space, a lever carried thereby liberates the catch, and allows the spring to act against the lever, by which the valve is shifted, and on the return motion of the piston-rod the same effect takes place by means of the liberation of another catch. The lever upon the piston-rod acts alternately upon the catches through the medium of set screws, by adjusting which the stroke of the diaphragm or piston may be altered at pleasure. It is proposed to connect the piston-rod to the spring at a situation between its fulcrum and point of action. The spring above alluded to is constructed as a fork, each prong being alternately charged.

Another part of the invention relates to a diaphragm-valve. Around a tube are formed passages for the fluid, which passages are provided with openings communicating with the said tube. These openings are situated on both sides of the diaphragm, and are capable of being opened and closed thereby alternately as it performs its strokes. The internal tube, to which the diaphragm is attached, is employed for conveying the fluid to be measured to the induction or eduction passages.

Another part of the invention relates to a method of obviating the necessity for ordinary stuffing-boxes for the piston or the valve-rods of meters. For this purpose, an india-rubber tube is employed, which is attached at one end to the diaphragm or piston, and at the other to the casing. The rod passes through this tube, and stretches it or allows it to contract duing the reciprocating motion. Or if an axial motion of the rod be required, as in the case of the valve above described, then the flexible tube is twisted, instead of being stretched lengthwise as aforesaid.

390.—Robert Dawson Clegg, of 22, Parkfield Street, Islington, in the co. of Middlesex, engineer, and Didier Louis Nicolas-Daubisgnye, of 29, Rue Hautefeuille, Paris, publicist, for "*Improvements in pumps.*" Application dated Feb. 8, 1866. Not proceeded with.

This invention consists, first, in the employment of eccentric wheels of various forms, fixed to supports upon the body of the pump, to work the piston, and so arranged that by means of a slide, with or without small wheels, they raise and lower the piston so as to raise and force water or other liquid. Secondly, in the employment of eccentric wheels placed in a groove in which they work. This groove is fixed to the piston-rod, there being appliances for the support of the axle of the eccentric wheel. Third, in placing an eccentric or concentric wheel in the interior of the body of the pump, working within pinions or sliding-stops, the axle traversing the body of the pump, and working by a handle or by cog-wheels or other motive power on the exterior. Fourth, of an arrangement of valves producing a double-action pump from one piston; and, fifth, in the arrangement of several pumps to be worked by one eccentric wheel.

412.—Charles Emile Giajola, of Birmingham, in the co. of Warwick, lamp-maker, for "*Improvements in privies and commodes.*" Patent dated Feb. 9, 1866.

This invention relates to water-closets, and consists in constructing them with a wood moveable seat in the usual way, beneath which seat is a metal fixed seat, to which a soil pan is attached. At the top of the soil-pan is a circular reservoir having a cover, formed with a deep flange made to fit into the reservoir, which is intended to contain water, so that when the cover is placed in position it effectually prevents any gas or unpleasant effluvia escaping from the soil-pan. A soil container is provided which travels on wheels into and out of its place under the soil-pan. On the neck of this container is also a reservoir intended to hold water, and into this reservoir the flange of the soil-pan dips. The invention also consists of an arrangement of blower or bellows raised by means of a lift-rod, and also of a blower-pipe, into which disinfectants may be admitted.

416.—James John Shedlock, of 6, Shaftesbury Villas, Kensington, in the co. of Middlesex, gas engineer, for "*Improvements in gas-burners.*" Patent dated, Feb. 10, 1866.

The objects attained by this invention are—the more perfect combustion of the gas, the greater regularity of the flame, and a great economy in the consumption for a given illuminating power. In order that the above advantages may be partially carried out, an inner chamber is provided, one end of which is closed by a cap, the other end being left open and forming the inlet for the gas. This inlet is made of such a size as to fit the gas-fittings in common use. The gas enters the inner chamber and passes out through a hole or holes into an outer chamber. The aperture through which the gas passes to be consumed is regulated by the outer chamber being made to rise or fall on the inner chamber, by means of a screw on the interior of the outer chamber, and a corresponding screw on the exterior of the inner chamber; or the interior of the outer chamber may be made to fit closely the exterior of the inner chamber, or by any means that can be adopted for the purpose of making a gas-tight joint between the inner and outer chambers. The upper part of the outer chamber is made of such a size and shape that the raising and lowering of the outer chamber on the inner chamber will regulate the quantity of gas necessary to give the required light in a very effectual manner.

434.—Charles Denton Abel, of 20, Southampton Buildings, Chancery Lane, in the co. of Middlesex, patent agent, for "*Improvements in gas and air engines.*" A communication. Patent dated, Feb. 12, 1866.

In igniting combustible gases inside a closed metallic vessel, the heat generated is imparted to the gaseous products of combustion, which, if prevented from expanding, in consequence of such increase of temperature will exert a proportionate pressure upon the surfaces of the closed vessel. This pressure would remain constant if no heat were taken away from the gases, but will in reality diminish rapidly, in consequence of the heat generated being absorbed by the metallic surfaces of the vessel. Experience has shown that the interval of time which elapses between the heating and consequent expanding of the gases, and the subsequent cooling and consequent contracting of the same, is but a very short one, and therefore, in applying the expansive force of such heated gases as a motive power, unless they are allowed to expand very rapidly immediately after the combustion has taken place, a great portion of the heat that should have produced such expansion will be absorbed by the cylinder of the engine, and consequently a great proportion of the motive power will be lost.

In employing the ordinary arrangement of connecting-rod and crank motion for transmitting the expansive force of the gases behind the piston to the engine-shaft, such force has to overcome not only the work allotted to it, but also the inertiæ of the whole of the moving parts of the engine, in addition to which the motion of the piston is controlled in a very prejudicial manner by the action of the crank; the heated gases are thus prevented from expanding with anything like the requisite rapidity, and a considerable loss of useful effect consequently takes place, as above mentioned.

In the specification to certain letters patent granted to Richard Archibald Brooman, for "An invention of improvements in air and gas engines," being a communication from Auguste Nicol Otto, and bearing date Aug. 24, 1863, No. 2098, it was proposed to remedy the before-mentioned defect of the gas-engine as heretofore constructed by employing such an arrangement of engine that upon the ignition of the gases in the cylinder the gaseous products of combustion were allowed to expand with rapidity without having to overcome any other resistance than the inertiæ of a very light displacing-piston, whilst the actual work was subsequently performed by the pressure of the atmosphere acting against the partial vacuum produced in the cylinder by the expansion and subsequent cooling of the gases, such pressure being effected against a second piston in the same cylinder, which piston was connected to the crank-shaft in the ordinary manner.

The present invention consists in so arranging engines working on the principle above named, that the hot gases in expanding, instead of acting upon a separate displacing-piston, as in the above-described arrangement, are made to act directly upon the working piston, which, in performing its stroke consequent upon such action, moves entirely independent of the engine-shaft, and consequently without performing any work; while, when it is caused to move in the contrary direction by the pressure of the atmosphere against the partial vacuum formed behind it, it is connected with the engine-shaft, and causes the same to revolve.

444.—Montague Richard Leverson, of 66, Bishopsgate Street Within, in the City of London, solicitor and patent agent, for "*Improvements in the manufacture of gas suitable to be used for illumination, or for obtaining heat or motive power.*" A communication. Provisional protection only obtained. Dated Feb. 13, 1866.

This invention consists in charging atmospheric air with the vapour of a volatile hydrocarbon, such as is prepared from earth oil or petroleum. This oil is placed in a vessel in which are a number of shelves supporting wicks or like absorbent material, such as cotton or sponge. The hydrocarbon is poured in at the top of the vessel on to the upper shelf, which it fills until it runs off by an overflow on to the second shelf, from which it overflows to the third shelf, and so it supplies all the shelves, whatever the number employed, which may be varied. This vessel is immersed in a cistern of water, which is kept tepid conveniently by means of a gas flame. Air is forced into the vessel by suitable machinery, and is made to pass over the wicks or materials on the shelves, and these being saturated with the hydrocarbon, the air becomes fully charged with the vapour, and it is then inflammable. A suitable pipe or pipes connected with the vessel lead the gas to the burners. The amount of hydrocarbon vapour supplied to the air to render it inflammable can be adjusted either by regulating by a cock the amount of air passing to the vessel, or by regulating by another cock the size of the flame which heats the water-cistern.

447.—Samuel Marland, of Clayton, near the city of Manchester, oil refiner, William Horatio Smith, of the same place, manager, and William Wells, of the city of Manchester, gentleman, for "*Improvements in obtaining and applying artificial heat, and in apparatus employed therein.*" Provisional protection only obtained. Dated Feb. 13, 1866.

This invention is particularly applicable to obtaining artificial light by causing atmospheric air to combine with the inflammable vapour given off by distilled petroleum, or other suitable volatile liquid, as in such process it is essential to apply a moderate degree of heat to the vessel containing the volatile liquid. The invention consists in generating the requisite heat for evaporating volatile liquids, and for other purposes, by chemical agents instead of by steam, or by heated products of combustion. It is found by experiment that sulphuric acid and water, combined in different proportions, according to the temperature to be attained, give a good result; but other acids and chemical agents may be found to answer the purpose.

454.—Joseph Beverley Fenby, of Birmingham, in the co. of Warwick, mechanical engineer, for "*Improvements in pumps for raising and forcing liquids.*" Patent dated Feb. 13, 1866.

This invention consists of the arrangement of the parts of pumps, whereby greater simplicity and efficiency are secured in pumps for raising and forcing a continuous and uniform, or nearly uniform, stream of liquids. This is effected by so combining or arranging two pump-barrels that the pistons or plungers are simultaneously raised and lowered, and in the construction of an air-vessel or chamber, for the purpose of equalizing the stream passing from the delivery-pipe, so as to make the flow practically constant and uniform.

478.—James Young, of Limefield, in the co. of Mid Lothian, gentleman, for "*Improvements in distilling coal, shales, and other substances.*" Patent dated Feb. 15, 1866.

This invention consists in the employment of a retort placed at an angle, and so constructed that it may be made to revolve, and that such revolution shall cause the materials placed therein to descend or pass through the retort, which, being heated externally, will effect their distillation. The retort or distilling apparatus may be constructed of iron or other suitable material, and provided with an arrangement for the charging of the same with the materials to be distilled, and also with an arrangement for their discharge after distillation. Exit-pipes, through which the volatile products of distillation pass off, are also adapted to the retort or distilling apparatus, in order that such volatile products may be collected and utilized.

497.—William Clay, of Liverpool, in the co. of Lancaster, iron manufacturer, for "*Improvements in economizing the heat of gas-producers.*" Provisional protection only obtained. Dated Feb. 16, 1866.

The object of this invention is to economize the heat given off by the gas-producers used in producing the gaseous fuel for Siemens's regenerative furnaces. Hitherto these gas-producers have been built of brick, in the form of single or double kilns, and all the heat generated within the kilns in effecting the distillation of the coal has been lost in radiation. In order to utilize this heat, it is proposed to form the double or single kilns of iron with a water-tight jacket all round, and at the top thereof. The fire-bars it is preferred to make tubular, and to connect them with the water-spaces at the opposite sides of the kiln. In the top part of the water-space is formed a steam-chamber, the steam from which is led off to wherever it may be required. The hoppers on the top part of the kiln pass through the water-space, and the pipe for leading off the gas generated in the kiln may, if thought desirable, have the water-jacket extending upwards to any required distance. By this arrangement a considerable amount of steam may be produced without detrimentally affecting the distilling operation.

504.—John Fletcher, of Ashton-under-Lyne, in the co. of Lancaster, brass-founder, for "*Improvements in valves for regulating the pressure of steam and other fluids.*" Patent dated Feb. 17, 1866.

This invention consists in applying an ordinary stop-valve and inverted regulating cone, plug, or valve, fitted within a case in which are holes or ports for the entrance and exit of the steam or other fluid. This regulating plug is fixed to a spindle, which is weighted in any convenient manner. In order to dispense with a stuffing-box, the spindle passes through a flexible metal diaphragm. Above the case containing the regulating-valve is screwed a bush, fitting in the case of the stop-valve. This bush is secured by a cap and gland, forming a steam-tight joint. To this bush is screwed a flange, between which and another similar flange the flexible diaphragm above referred to is securely held. When this regulating-plug is in operation, the pressure of steam or other fluid causes it to rise as soon as the pressure overcomes the weight on the spindle, thus closing the ports in the case, and when the pressure is below the weight on the spindle, the plug drops, to open the ports, and allow the steam or other fluid to pass at the required pressure. The traversing of the regulating-plug is limited by a lock and nut screwed on the spindle.

## APPLICATIONS FOR LETTERS PATENT.

2244.—Charles Denton Abel, of 20, Southampton Buildings, Chancery Lane, in the co. of Middlesex, patent agent, for "*Improvements in joints or connexions for pipes.*" A communication. Aug. 31, 1866.

2248.—Henry George Scott, of Leeds, in the co. of York, civil engineer, and Nathan Hallewell, of Greenhill, near Sheffield, in the co. of Derby, mechanical engineer, for "*Improvements in valves for pumps, said improvements being also applicable to steam-valves.*" Aug. 31, 1866.

2277.—William Thomas Sugg, of Vincent Works, Vincent Street, in the city of Westminster, for "*Improvements in apparatus for regulating the supply of gas.*" Sept. 5, 1866.

2280.—James Wilson, of Royal Exchange Buildings, in the City of London, civil engineer, for "*Improvements in street gas-lamps.*" Sept. 5, 1866.

2315.—Frederick Warner, of Jewin Crescent, Cripplegate, in the City of London, William Stewart, of Carthusian Street, also in the City of London, and George William Barber, of King Street, Southsea, in the co. of Hants, for "*Improvements in water-closets, and in valves and regulating apparatus for the same, and other purposes.*" Sept. 8, 1866.

2319.—Alfred Vincent Newton, of 66, Chancery Lane, in the co. of Middlesex, mechanical draughtsman, for "*Improvements in the manufacture of seamless metallic tubes.*" A communication. Sept. 10, 1866.

2331.—William Olley, of Enfield, in the co. of Middlesex, mechanic, for "*Improvements in apparatus for separating animal and vegetable matters from water and other liquids.*" Sept. 11, 1866.

2333.—Robert Anthony Hardcastle, of the town and county of Newcastle-upon-Tyne, for "*Improvements in apparatus for measuring and indicating the quantity of liquid drawn off thereby.*" Sept. 11, 1866.

2357.—George Henderson and David M'Neil, both of Blackfriars Road, in the co. of Surrey, for "*Improvements in hydraulic gas-chandeliers and in gas-regulators applicable thereto, and to other gas-burners or meters.*" Sept. 13, 1866.

## GRANTS OF PROVISIONAL PROTECTION.

1516.—Edward Taylor Bellhouse and William John Dorning, both of Manchester, in the co. of Lancaster, engineers, for "*Certain improvements in hydraulic pumps and in valves connected therewith, and also in the method of driving or actuating such pumps.*" May 31, 1866.

2014.—William Jackson, of Birmingham, in the co. of Warwick, engineer, for "*A new soufflating accumulating pump or hydraulic engine.*" Aug. 4, 1866.

2047.—James Turner, of Fleming Road, Walworth, in the co. of Surrey, gas-meter maker, for "*Improvements in wet gas-meters.*" Aug. 9, 1866.

2064.—John Edwin Keirby, of Parker Street Mill, Manchester, in the co. of Lancaster, india-rubber merchant, for "*Improvements in packing for steam, water, air, and gas-tight joints.*" Aug. 11, 1866.

2067.—John Israel Ensley, of the city and state of New York, U.S.A., machinist, for "*An improved apparatus for manufacturing illuminating gas and producing bone-black and other valuable residuum.*" Aug. 11, 1866.

2096.—Charles Brown, of 43, Mark Lane, in the City of London, gas engineer, for "*A new or improved apparatus for consuming smoke from gas and other lamps.*" Aug. 15, 1866.

2125.—George Edward Moore, of Birmingham, in the co. of Warwick, metal dealer, for "*Improvements in apparatus for filtering and purifying water and other fluids.*" Aug. 18, 1866.

2145.—William Edward Newton, of 66, Chancery Lane, in the co. of Middlesex, civil engineer, for "*Improvements in the mode of and apparatus for the distillation, rectification, and disinfection of mineral or vegetable oils, applicable also to the purification and rectification of fatty and other products of such oils.*" A communication. Aug. 21, 1866.

2183.—Josiah George Jennings, of Palace Wharf, Stangate, in the co. of Surrey, sanitary engineer, for "*Improvements in water-closets, urinals, and taps.*" Aug. 24, 1866.

2201.—William Pierce, of Over Darwen, in the co. of Lancaster, manufacturing chemist, for "*Certain improvements in the method of purifying gas, whereby its illuminating properties are improved, and in the apparatus connected therewith.*" Aug. 27, 1866.

2206.—The Rev. Thomas Davis, of Roundhay, in the co. of York, clerk, for "*An improved method of or apparatus for ventilating dwelling-houses or other buildings.*" Aug. 27, 1866.

2218.—Robert Irvine, of Magdalen Bridge, near Musselborough, in the co. of Mid Lothian, N.B., for "*Improvements in treating and purifying water.*" Aug. 28, 1866.

## NOTICES TO PROCEED.

1162.—Alfred Upward, of the Chartered Gas Company, 146, Goswell Road, in the co. of Middlesex, civil engineer, and the Honourable Arthur Auckland Cochrane, of Westminster, for "*Improvements in the manufacture of gas.*" April 25, 1866.

1206.—Henry Edward Newton, of 66, Chancery Lane, in the co. of Middlesex, mechanical draughtsman, for "*Improvements in engines for obtaining rotary motion, by means of steam, gas, or other fluids.*" A communication. April 28, 1866.

1230.—Joseph Lewis, of Manchester, in the co. of Lancaster, engineer, for "*Improvements in valves used as in the case of slide-valves for regulating the flow of steam, water, and other fluids.*" May 1, 1866.

1239.—David Cohen, of 24, Leigh Street, Burton Crescent, in the co. of Middlesex, gas-meter maker, for "*Improvements in dry gas-meters.*" May 2, 1866.

1278.—William Young, manager of the Oil-Works, Straiton, in the co. of Mid Lothian, and Peter Brash, of Leith, in the same co., soap, candle, and oil manufacturer, for "*Improvements in the distillation of coal, shale, and other bituminous substances, to obtain oily matters therefrom, also in the redistillation of products thereby obtained.*" May 4, 1866.

1888.—Marc Antoine François Mennons, of the firm of Mennons and Telescheff, home and foreign patent agents, of 8, Southampton Buildings, in the co. of Middlesex, and 27, Rue Laffitte, Paris, in the empire of France, for "*Improvements in the mode of and apparatus for generating gas for lighting, heating, and other purposes.*" A communication. July 20, 1866.

## PATENTS WHICH HAVE BECOME VOID

BY REASON OF THE NON-PAYMENT OF THE ADDITIONAL STAMP DUTY OF £50 BEFORE THE EXPIRATION OF THE THIRD YEAR.

2102.—John Walter Friend, "*Improvements in the construction of gas-meters, and in apparatus to be employed in connexion therewith for regulating the pressure and flow of gas to the same.*" Aug. 26, 1863.

2126.—Edouard Amourous, "*Improvements in apparatus for separating solid from fluid fœcal matters.*" Aug. 28, 1863.

2162.—George Tomlinson Bousfield, "*Improvements in the manufacture of illuminating gas.*" Sept. 1, 1863.

# Miscellaneous News.

## REPORT OF THE ILLUMINATING POWER OF THE GAS SUPPLIED TO THE CITY OF LONDON

During the Summer Quarter of 1866.

*To the Honourable Commissioners of Sewers of the City of London.*

Gentlemen,—I submit my report of the illuminating power and chemical quality of the gas supplied to the City during the summer quarter which has just elapsed.

The illuminating power of the gas of the three companies has been tested on 774 occasions, and each testing was the average of ten photometrical observations. The results are as follows:—The highest illuminating power of the gas has been, in the case of each of the companies, above 16 standard sperm candles, and the lowest illuminating power has never been under 12 candles, the average in the three cases having been 14·06 candles for the Great Central gas, 14·33 for the Chartered, and 14·35 for the City of London Company. A comparison of these results with the testings of the gas during the summer quarter of 1865, and with the average quality of the Great Central gas during the corresponding period of the last 14 years, will stand thus:—

| | | Illuminating Power in Standard Sperm Candles. Summer Quarter, 1866. | Summer Quarter, 1865. | Ditto from 1852 to 1865. |
|---|---|---|---|---|
| Great Central gas | New burner | 14·06 | 14·23 | 13·93 |
| | Old burner | 12·57 | 12·72 | 12·40 |
| Chartered gas | New burner | 14·33 | 14·33 | — |
| | Old burner | 12·81 | 12·81 | — |
| City Co.'s gas | New burner | 14·35 | 14·19 | — |
| | Old burner | 12·76 | 12·68 | — |

It thus appears that the illuminating power of the gas supplied to the City by each of the companies has been a little higher than the average power of the Great Central gas during the preceding 14 years.

The chemical quality of the gas has been somewhat variable. In the case of the Chartered gas the amount of sulphur per 100 cubic feet has never exceeded 20 grains, the minimum having been only 11·69 grains, and the average for the whole quarter 15·87 grains; but in the City of London gas the maximum amount of sulphur has been 24·71 grains per 100 feet, and minimum 14·61 grains, the average having been 19·15 grains; while in the Great Central gas the maximum has been 26·71 grains, the minimum 14·79 grains, and the average 21·65. Of 63 examinations of the City Company's gas for sulphur, it was found that the parliamentary quantity was exceeded on 22 occasions, and of 66 examinations of the Great Central, it was exceeded 47 times, there having been no instance when the Chartered gas contained more than 20 grains per 100 feet. It is manifest from this that the quantity of sulphur can be kept down to the Parliamentary standard, and that the constant excess of it in the Great Central gas, as shown in the successive quarterly reports for many years, is proof either that the company is incompetent to manufacture gas of proper purity, or that it is unwilling to do so. In other parts of the metropolis, I find that the amount of sulphur is considerably less than 20 grains per 100 cubic feet of gas; thus, for example, the gas of the Imperial Company and of the Chartered Company as supplied from Horseferry Road, Westminster, is reported by Dr. Whitmore as not containing more than from 11 to 17·23 grains as the average of a whole quarter; and the gas of the Phœnix Company, as tested at Greenwich, Kennington, and in the Blackfriars Road, rarely contains more than 10 grains of sulphur per 100 feet; while that of the Crystal Palace Company is found to range from about 11½ grains to 16·5. There is no good reason, therefore, why the Great Central Company should continue to supply gas of such impure quality.

As regards the presence of other impurities in the gas, I have to report that the gas of all the companies has been constantly free from sulphuretted hydrogen, and that, with the exception of the Chartered gas, there has never been an excess of ammonia.

The pressure at which the gas has been delivered to the public, as registered at the laboratory in Aldgate, has ranged from 2½ inches to about 1 inch of water, the average pressure being about an inch and a half.

—I remain, Hy. Letheby.

*Guildhall, Sept.* 11, 1866.

## Return of Quality of the Gas supplied to the City of London for the Quarter ending Saturday, Sept. 1, 1866.

*Illuminating Power, Sperm = 120 Grains per Hour.*

| | City Company. | Chartered Company. | Great Central Company. |
|---|---|---|---|
| Maximum | 16·01 | 16·23 | 16·71 |
| Minimum | 12·70 | 12·26 | 12·13 |
| Average | 14·35 | 14·33 | 14·06 |
| Total number of observations in quarter | 243 | 239 | 292 |
| *Amount of Sulphur present (Grains) per 100 Cubic Feet.* | | | |
| Maximum | 24·71 | 19·76 | 26·71 |
| Minimum | 14·61 | 11·69 | 14·79 |
| Average | 19·15 | 15·87 | 21·65 |
| Total number of observations in quarter | 63 | 65 | 66 |
| Ditto ditto when in excess of standard | 22 | .. | 47 |
| *Pressure of the Gas in 10ths of an Inch of Water.* | | | |
| Maximum | 3·3 | 2·4 | 2·5 |
| Minimum | 0·8 | 0·7 | 1·2 |
| Average | 1·6 | 1·2 | 1·54 |

## UNITED GENERAL GASLIGHT COMPANY.

The Half-Yearly General Meeting of the Shareholders of this Company was held on Tuesday, Sept. 4, at the London Tavern—R. Hudson, Esq., the chairman of the board of directors, presiding.

The following report was presented:—

The directors have to submit the following report and accompanying accounts of the company's operations, by which it will appear that the profits of the half year ending June 30th amount to £8949 8s. 8d. At Dublin there has been a moderate improvement in the rental during the last six months. The profits, however, are not so large, owing to the increased cost of coals and the depreciated value of the products.

The proprietors are already aware that during the recent session of Parliament the company's Dublin Bill, for carrying out the arrangement with the Alliance and Dublin Consumers Gas Company, went through the several stages. The directors have now to report that the Royal Assent was obtained in July last.

At Limerick the improvement in both rental and residual products has been very satisfactory. The profits, as before stated, amount to £8949 8s. 8d., which, added to the dividend reserve-fund of £2143 9s. 2d., makes a total of £11,092 17s. 10d., from which the directors recommend that a dividend of 20s. per share and a bonus of 2s. per share, amounting to £9900, both free of income-tax, be declared, payable on and after the 1st of October next.

Three of the directors—Mr. Bell, Mr. Bostefeur, and Mr. Chapman—and Mr. Smyth, one of the auditors, go out of office this day, by rotation, and being eligible, offer themselves for re-election.

The Chairman, in moving the adoption of the report, said the company were about to make over the concern to the Alliance Company, and two eminent engineers had been engaged—Mr. Hawksley on behalf of the company, and Mr. Barlow on behalf of the Alliance Company—to make a valuation of their works and stock. Of course it was impossible for him to state what the result of the valuation would be, but as soon as it was made known to the directors they would call a meeting of the proprietors, at which, amongst other things, it would be taken into consideration what should be done with the *employés* who were not engaged by the Alliance Company.

Mr. Rhodes seconded the motion.

Mr. Godfrey called the attention of the meeting to the desirability o laying before them a scheme for the future management of the Limerick business.

Mr. Lysley, M.P., thought it would be perfectly absurd to keep up the company for the sake of the works at Limerick.

The Chairman said the board had not lost sight of the Limerick business. He believed the concern there was too small to require the attention of a board in London, but they had not yet come to any decision in the matter. However, they would be able, at the next meeting, to state what determination had been come to.

Replying to a question from a shareholder,

Mr. Stephenson said the terms of the agreement with the Alliance Company were that the works would be handed over to them on the 29th of the present month on the valuation of Messrs. Hawksley and Barlow, the sum paid to be not less than £240,000, and not more than £270,000. When the Alliance handed them the money, they would have to pay 5 per cent. up to the date of its payment. He believed the shares of the Alliance would not be given to their company until March, and then they would receive the dividend *pro ratâ*.

A Shareholder asked if the 5 per cent. was on the whole amount of the valuation.

Mr. Stephenson replied in the affirmative.

A Shareholder expressed the belief that there was no necessity for the re-election of the retiring directors.

Mr. Gregory (solicitor of the company) said the charter provided that there should be nine directors and four auditors.

Mr. Stephenson thought it would be well to state by way of explanation that the scheme which the company brought before Parliament comprised two bills—one for the transfer of their works to the Alliance Company, and the other having reference to the concern at Limerick. The Limerick Bill, by which it was sought to hand over the works in that city to a small company, to be called the Limerick Gaslight Company, was, as they were aware, rejected in the House of Lords. If they had been successful with that bill, they would have done away with their charter to the old company. The corporation gas-works in Limerick were now in the Encumbered Estates Court, and there was no doubt that ultimately their company would buy them, or *vice versâ*. The directors had received an offer for the sale of the works at Limerick, but the sum was so inadequate that they had rejected it without hesitation. He entirely coincided in the assertion that it would be preposterous to keep up the management of the company for the sake of the Limerick business. He thought it would be worth the consideration of the shareholders to try and extend their operations by the acquirement of gas-works in England, and he thought that in London or its vicinity works might be obtained so as still to retain the old charter, and could really bear a management. The principal value of the charter lay in the fact that it gave them power to break up roads in any town where they might contract for the public lighting, and they had exercised the power in Dublin, Cork, Limerick, and Plymouth.

The motion as to the adoption of the report was then put, and agreed to unanimously.

A motion in favour of the declaration of the dividend recommended was also adopted.

The retiring directors were unanimously re-elected.

A vote of thanks to the chairman concluded the business.

## OTTOMAN GAS COMPANY.

The Eighth Ordinary General Meeting of this Company was held on Monday, Sept. 10, at the London Tavern—Mr. HORNER in the chair.

The following report and statements of account were presented:—

Gentlemen,—Your directors have the pleasure to present the audited statement of accounts for the past half year, showing a net profit of £431 9s. 10d.

The progress of the undertaking, though not so rapid as both directors and shareholders had reason to expect, is still not altogether unsatisfactory; the receipts for gas supplied to general consumers being £1048 0s. 10d. against £493 5s. 11d. for the corresponding period of last year.

The shareholders have already been made acquainted with the position of the public light question. The case remains in the same position as it was when the address to the shareholders of August 7th was published. The board is resolved not to accede to the demands which have been made by the sub-commission of consuls for a reduction of price to 500 piastres per lamp; nor does it intend to resume lighting until the arrears due to the company have been discharged, free of all charge for collecting, or until some satisfactory arrangement can be made; in which resolution they hope they will be supported by the proprietors.

In regard to the hostile measures threatened by the sub-commission, your directors have taken steps to ensure the protection of the Foreign Office against any injury to your rights and property.

The shareholders will see that, owing to the heavy amount of arrears due for the public lamps, the company is without funds. It is absolutely necessary that the board should be provided with money, not only for the current working expenses, but for those extensions of mains, which the manager reports to be necessary, and which promise good results on the outlay. The sum still remaining to be taken up on debentures is £2750, and as this sum is needed for the proper working of the undertaking, the directors confidently trust that the proprietors will, at the meeting on the 10th instant, take up this small balance.

In conclusion, the directors are sanguine that if the same rate of progress be maintained for another year, and the vexed question of the public lighting be satisfactorily settled, a prosperous condition of the company may be fairly anticipated.

*Dr.* — *Balance-Sheet, June 30, 1866.* — *Cr.*

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| To Capital | | | £50,000 | 0 | 0 | | |
| Debentures | | | 12,250 | 0 | 0 | | |
| Loan account | | | 1,000 | 0 | 0 | | |
| Sundry creditors | | | 1,842 | 19 | 11 | | |
| | | | | | | | |
| | | | £65,092 | 19 | 11 | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| By Concession and preliminary expenses | | | | | | £16,888 | 9 10 |
| Plant | | | | | | 39,747 | 18 0 |
| Stocks | | | | | | 4,126 | 8 3 |
| Amount owing for public lights | | | | | | 2,191 | 8 6 |
| Sundry debtors | | | | | | 855 | 3 6 |
| Cash | | | | | | 765 | 6 0 |
| Bills receivable | | | | | | 300 | 0 0 |
| Suspense account | | | | | | 95 | 9 2 |
| Office furniture | | | | | | 98 | 2 3 |
| Profit and loss—balance from last account | | | £ 456 | 4 | 3 | | |
| Less profit on this half year | | | 431 | 9 | 10 | | |
| | | | | | | 24 | 14 5 |
| | | | | | | £65,092 | 19 11 |

*Dr.* — *Profit and Loss Account, January 1 to June 30, 1866.* — *Cr.*

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| To Cost of coals | | | £ 907 | 12 | 2 | | |
| Wages and proportion of general expenses at Smyrna | | | 739 | 14 | 1 | | |
| | | | £1,647 | 6 | 3 | | |
| Directors fees | | | | | | | |
| Interest account | | | 39 | 8 | 11 | | |
| Ditto on debentures | | | 337 | 10 | 0 | | |
| Wear and tear | | | 159 | 15 | 1 | | |
| Exchange account | | | 17 | 13 | 9 | | |
| Rent, salaries, and office expenses, London | | | 192 | 7 | 6 | | |
| Balance, profit | | | 431 | 9 | 10 | | |
| | | | £2,816 | 11 | 4 | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| By Gas-rentals— | | | | | | | |
| General consumers | | | £1,048 | 0 | 10 | | |
| Public lights | | | 1,137 | 19 | 1 | | |
| | | | | | | £2,185 | 19 11 |
| Sales of coke and tar | | | | | | 312 | 14 4 |
| Profit on fittings and meters | | | | | | 266 | 1 4 |
| Meter-rents | | | | | | 50 | 0 9 |
| Transfer fees | | | | | | 1 | 15 0 |
| | | | | | | £2,816 | 11 4 |

The CHAIRMAN, in moving the adoption of the report and accounts, said the company had met with an amount of bad faith on the part of town authorities which was unparalleled. He believed, however, that if the shareholders would only support the board, and find the necessary capital for carrying on the works, the difficulties in the way would be surmounted; because the Turkish people were beginning to appreciate the advantages of gas, and the demand for private lights increased weekly. The directors were determined to do all in their power to secure economy, and among other things had not charged anything as remuneration for their services.

The Hon. H. BROWNE seconded the motion, and explained that the sum of £2750 was wanted because the public lights had not been paid for.

The report and accounts were unanimously adopted.

At the conclusion of a long discussion the following gentlemen were elected a friendly committee of consultation to confer with the board, in order to strengthen the company's position in Smyrna:—Messrs. Coles, Knight, Oxenham, Williams, and Van Voorst.

A vote of thanks to the directors and chairman closed the proceedings.

## NEWCASTLE AND GATESHEAD GAS COMPANY.

The Annual General Meeting of the Shareholders of the Newcastle and Gateshead Gas Company was held on Wednesday, the 5th inst., at the Company's Office, Neville Street—JOHN CLAYTON, Esq., chairman of the board of directors, presiding.

The notice calling the meeting having been read, and the register of shareholders sealed,

The SECRETARY (Mr. W. Hardie) read the report of the directors, as follows:—

The directors, in submitting to the shareholders a statement of the affairs of the company for the year ending the 30th day of June, 1866, have to report that the sum of £7483 4s. 7d. has been expended in extensions properly chargeable to capital which has been paid out of money raised on debenture under the borrowing powers of the company.

Upwards of 18 miles of mains of various sizes have been laid, the advantage of which is partially shown by the increase in the receipts of the company, though the full effect of these extensions remains to be developed, by means of the rapidly increasing consumption of gas upon the lines of extension.

In the early part of the present year, Mr. Arnott, the late manager of the works, left the employment of the company, and at the same time the directors were called upon to contend with a combination of the workmen. These circumstances occasioned some disarrangement of the works, and a considerable expense to the company, which the directors trust will not again occur. In consequence of this, and the increasing demand for gas rendering it necessary to increase the plant, the directors have called for the assistance of Mr. Laidlaw, gas engineer, and under his advice the alterations necessary for affording increased facilities for the manufacture and distribution of gas are now in progress.

The intended removal of the Tyne Bridge has rendered it necessary to open negotiations with the River Tyne Commissioners for the removal of the mains on and the transmission of gas across the river, and the contribution to be paid to the company.

The receipts for the past year exceed those of the previous year by £6338 10s. 5d., but no advantage accrues to the company, as, from various causes, the expenditure has increased in a larger proportion. A very considerable loss was incurred in the struggle with the workmen, and the consequent disarrangement of the works, but this charge upon the annual revenue of the company is of a character so exceptional as to render it proper that the directors should carry over a portion of this loss to next year's account.

The directors recommend a dividend of 4 per cent. for the half year on the A stock, which with the dividend paid in February, is at the rate of 9 per cent. for the year, and a dividend of £1 8s per cent. on B stock for the half year, which, with the dividend paid in February, is at the rate of £3 3s per cent. per annum.

Mr. Gray, of the Dunfermline Gas Works, has been appointed manager of this company's works.

The present directors, Messrs. John Clayton, M. Anderson W. Douglas, T. Hedley, W. Brown, F. Staniford, W. Kimptser, T. W. Keenlyside, and Jos. Kimpster, and the present auditors, Messrs. R. White and T. Richardson, retire, but are eligible and offer themselves for re-election.

The CHAIRMAN rose to move the confirmation of the report. There was only one circumstance which needed any particular remark on his part; that was the great expense and loss which had been incurred by resisting the combination of the workmen. The directors, rather than submit to a combination—though it might have been the best immediate policy with a view to the dividend at the end of the year—determined to set their face against it. The result was, that they were compelled to discharge no less then 80 men from the works, and supply their places with raw hands, who did not for a time understand their business. He was happy to be able to say, however, that they had got completely inured to the works, and were able to do their business to the satisfaction of the company. Some of the directors were of opinion that they ought to bear the whole loss in the present year; but looking at the future—looking at the better prospect they had for next year, in every respect of an exceptional character—the majority of them thought it would be better to divide the loss between the two years. The shareholders would bear in mind that the profits of a succeeding year would enable them to replace what they had been obliged to retain, under the circumstances, during the present year. Acting on the terms of their Act of Parliament, they had determined that the deficiency dividend—that was, the deficiency below 10 per cent of the A stock, and below 3½ per cent. of the B stock, might be borne by a rule-of-three question, between these stocks. They had acted accordingly. There was only one other passage in the report upon which he need say a word, and that was the subject of the treaty between the gas company and the River Tyne Commissioners. He believed both parties would do what was right and reasonable; but during the negotiations the less said the better. He could only say that no sum had been asked by them, and no sum offered by the River Tyne Commissioners. Therefore it was an open question. Having made these few observations, he would move the adoption of the report, and the payment of dividends, as stated in the report, payable by warrants on September 13.

Mr. W. DOUGLAS seconded the motion.

Mr. J. S. CHALLONER asked whether the directors had taken any opinion as to the B stock—whether it was not the intention that the B stock should receive 3½ per cent.—that both stocks should receive 3½ per cent. so long as it would pay that, and the remainder to be divided to the A stock. If they remembered, the question was mooted at the last meeting. He had considerable doubt about it. He wished to know whether any opinion had been taken.

The CHAIRMAN said they had looked at decisions in similar cases, and they had applied reason and common sense, with what little law they had, to their own Act of Parliament, and had come to the conclusion that they should deal with both stocks alike.

Mr. CHALLONER said he believed the clause was inserted by Lord Redesdale. He had written to Lord Redesdale and his lordship did not seem to be very clear about it.

The CHAIRMAN: He does not like to give opinions. His lordship refers you to lawyers.

Alderman KEENLYSIDE: The clause was not prepared by Lord Redesdale, but by the lawyers.

Mr. CHALLONER: But it was suggested by his lordship.

The CHAIRMAN: Lord Redesdale fixed the limit.

Mr. BURDON: I think it a great pity that the gas company should have got so much abused about the bridge.

The CHAIRMAN: They have made no demands.

Mr. BURDON: A great many lies must have got circulated.

The CHAIRMAN: It is rather the habit of the world to circulate lies.

Alderman KEENLYSIDE said the statement in the papers about the claims made by the company was totally incorrect. No offer was made by either side, but negotiations were now going on, with respect to the statement as to the company asking for a certain price, and asking to take the pipes over the bridge; he had in his hand a letter that had been received in repli to Mr. Philipson, from the Tyne Commissioners. The letter was dated the 30th July, and stated that "the amount to be paid by the gas company to the commissioners, for the use of their property, they are willing to fix mutually or to leave it to arbitration, as the gas board may desire."

Dr. HARDCASTLE asked if it was the intention of the board to appeal against the fine imposed by the magistrates at the police-court.

The CHAIRMAN said they had taken proceedings for the purpose. They considered it was a conviction that could not be maintained at law.

The report was then adopted.

The retiring directors and auditors having been re-elected, the meeting terminated.

## PARIS GAS COMPANY.

REPORT PRESENTED TO THE GENERAL MEETING, HELD MARCH 17, 1866.

Gentlemen,—During the year 1865, the development of our enterprise has followed its ascending march. The number of our customers has continued to increase, although, under the influence of exceptional circumstances, the progress in the consumption of gas has not, during this year, completely attained its usual proportions.

The consumption of gas, which in 1864 had been 3,871,096,475 cubic feet, increased in 1865 to . . . . . 4,102,836,882 „

Which is an increase of . . . . . 231,740,407 „ or about 6 per cent. on the year.

The day consumption, which is almost entirely for manufacturing and domestic purposes, figures in the total consumption for 467,461,392 cubic feet, which is an increase of about 5½ per cent. on the preceding year.

| | | | |
|---|---|---|---|
| The receipts for gas alone amounted this year to | £1,133,966 | 16 | 7 |
| In 1864 they were . . . . . | 1,071,237 | 9 | 0 |
| Showing an increase in the year 1865 of . | £62,729 | 7 | 7 |

| | |
|---|---|
| The number of our consumers amounted, on the 31st of Dec. last, to . . . . . | 67,182 |
| At the end of 1864 it was . . . . . | 63,303 |
| The increase for the year 1865 is, therefore . . . | 3,879 |
| The total number of public lights at the end of the year was . . . . . | 20,838 |
| Which, compared with the number at the 31st of Dec., 1864, is an increase of . . . . . | 1,075 |

This increase is less than that of 1864, which was itself inferior to that of the preceding year. It may be observed here that the public lights already established in all the streets canalized, without probable increase, can only be developed on new canalization, while the private lighting develops itself upon all canalizations without any other limit than the wants of the consumers.

The preceding figures indicate to you, gentlemen, in what proportion the consumption of gas for lighting and heating has increased in 1865. If we consider the decennial period which terminated on the 31st of Dec., 1865, we find that the general increase in the consumption of gas has been in the proportion of 185 to 100.

The following table indicates the annual increases and the corresponding dividends:—

| Years. | Annual Consumptions. | Annual Increase in Consumption. | Annual Dividends per Share of £20. |
|---|---|---|---|
| | Cubic Feet. | Cubic Feet. | |
| 1855 . . . . | 1,440,029,484* | | |
| 1856 . . . . | 1,671,746,970 | 231,717,486 | £1 12 0 |
| 1857 . . . . | 1,979,257,916 | 307,510,946 | 1 16 0 |
| 1858 . . . . | 2,195,279,998 | 216,002,082 | 2 0 0 |
| 1859 . . . . | 2,388,422,172 | 193,142,174 | 2 8 0 |
| 1860 . . . . | 2,667,101,768 | 278,679,596 | 2 16 0 |
| 1861 . . . . | 2,974,774,784 | 307,673,016 | 2 16 0† |
| 1862 . . . . | 3,287,172,861 | 312,398,077 | 3 8 0 |
| 1863 . . . . | 3,561,128,172 | 273,955,311 | 3 16 0 |
| 1864 . . . . | 3,871,096,475 | 309,968,303 | 4 4 0 |
| 1865 . . . . | 4,102,836,882 | 231,740,407 | 4 4 0 |

* These figures represent the quantity of gas made by all the companies existing in 1855, and afterwards amalgamated in the Paris Gas Company.
† In 1861 the number of shares was increased from 110,000 to 168,000.

The increased consumption has necessitated a proportionate increase in the means of production. We have found it necessary to increase this year, as in preceding years, our manufacturing power. It has been carried to 4,485,259,000 cubic feet, so as always to keep us in a position to supply any presumed wants. This is an indispensable condition of security.

As we have already had occasion to tell you, gentlemen, this increase of our capital rendered necessary by the progress of consumption becomes a source of profit, all the more advantageous inasmuch as it increases our receipts without proportionally increasing our general expenses.

Our canalization has also extended this year. At the end of 1865 its total length was 714 miles. On the 31st of December, 1864, it was 607 miles; the increase, therefore, during the year has been 27 miles. The total of this canalization is thus divided between the three great divisions of our district.

| | | |
|---|---|---|
| Paris | Old limits . . . | 361 miles. |
| | Zone annexed . . | 216 „ |
| Suburbs . . . . . | | 137 „ |
| Total . . . . | | 714 „ |

The 27 miles of new mains which have been laid in the course of the year 1865 are divided as follows:—

| | |
|---|---|
| Paris—Old limits . . . . | 10 miles. |
| Zone annexed, and suburbs . | 17 „ |
| Total . . . . . | 27 „ |

We shall have also at a later period to lay mains in a certain number of streets in the zone annexed and in the suburbs, without speaking of the new roads which will be opened at different points of our three districts.

The staircase service-pipes established vertically, and which are the continuation in the interior of the houses of the conduits in the public roads, have for their object the placing of the gas at the disposal of the lodgers of the upper floors.

The expense to the company has been considerable, but experience has already proved that the returns are very remunerative. We do not hesitate, therefore, in continuing their supply. There is in it a certain prospect for the increase of consumption, and we regard as a success of good promise all introductions of gas into private apartments. In Paris it is a new customer which remains for us to acquire, and we will succeed in it as already has been the case in a great number of towns in England, in Germany, and in the United States.

### ABSTRACT OF EXPENSES ON CAPITAL ACCOUNT.

The expenses on capital account for the year 1865 have consisted principally—first, in the purchase of lands, either for the augmentation of several of our works or for the establishment of new works; second, in the construction of new gasometers, and in the finishing of the different works; in the development of our canalization, and the augmentation of our *matériel*.

### NEW WORKS.

| | | | |
|---|---|---|---|
| *Land purchased.*—First, for the increase of the works, especially those at Ivry; secondly, for the establishment of new works . . . . . | £58,715 | 0 | 0 |
| *La Villette.*—Works remaining for the finishing of the tanks and gasholders Nos. 11 and 12; purifying-house for 24 purifiers; 2 new station-meters, capable of passing 1,000,000 cubic feet of gas per diem; development of the interior canalization, with pipes of 28 inches diameter from the manufacturing department to the gasholders; and, lastly, the increase of the power of the brick manufactory . . . . . | 14,519 | 2 | 4 |
| *St. Mandé.*—Construction of two tanks and gasholders, new retort-house, and hydraulic mains . . . . . | 31,835 | 11 | 7 |
| *Vaugirard.*—Construction of tank and gasholder No. 8, hydraulic mains, and increase in the interior canalization . . . . . | 19,196 | 19 | 8 |
| *Passy.*—Increase in the power of the exhausters; completion of the purifying-house, with 16 purifiers; erection of a coal-shed; and increase in the interior canalization . . . . . | 9,174 | 14 | 1 |
| *Other Stations.*—Works for making the different manufacturing apparatus, proportionate to the producing power of the retorts . . . . . | 12,843 | 13 | 0 |
| *Central Magazine.*—Works in fitting up . . . . . | 2,842 | 16 | 7 |
| *Hotel of the Company.*—Expenses balanced in 1865 . . | 13,582 | 18 | 8 |
| *For the Erection of Houses in the Rue Maubeuge.*—Expenses balanced in 1865 . . . . . | 4,400 | 0 | 0 |
| Total . . . . . | £167,114 | 8 | 1 |
| *Canalization.*—During the year 1865, the length of our canalization has increased 27 miles. Beside which, we have been obliged to increase the diameter of a certain number of our conduits upon a length of 17 miles. The total cost of these works has been. . . | 64,427 | 15 | 9 |
| *Matériel.*—Service-pipes and new meters . . . . . | 23,981 | 5 | 10 |
| Increase in the number of waggons and horses . . . | 2,896 | 10 | 1 |
| Ditto, working tools . . . . . | 3,022 | 15 | 8 |
| Sundry expenses upon capital account . . . . . | 8,880 | 1 | 3 |
| Making a total of . . . . . | £270,322 | 16 | 8 |
| Our expenses on capital account being, on the 31st of December, 1864 . . . . . | £4,101,151 | 13 | 9 |
| From which there has been deducted the value of the land sold at Clichy and the Rue Bellefond . . . . | 24,800 | 0 | 0 |
| There remains . . . . . | £4,076,351 | 13 | 9 |
| Adding to this the sum expended in 1865 of . . . . | 270,322 | 16 | 8 |
| The total on the 31st of December last was . . . | £4,346,674 | 10 | 5 |

| | | | | | |
|---|---|---|---|---|---|
| Our capital being— | | | | | |
| In shares . . . . . | £3,360,000 | 0 | 0 | | |
| In debentures . . . . . | 1,074,307 | 0 | 4 | | |
| | £4,434,307 | 0 | 4 | | |
| Upon which there remained to be received on the 1st of January, 1866 . | 13,848 | 0 | 0 | | |
| | | | | 4,420,459 | 0 | 4 |
| It exceeds our expenditure by . . . . . | | | | £73,784 | 10 | 1 |

The treaties for lighting projected with the communes of Joinville-le-Pont, St. Maur, Bagnolet, Fontenay-sous-Bois, Clichy, Arcueil, Vanves, Gentilly, and Enghien-les-Bains, have been approved by the Préfet of the Seine. Those of the communes of Boulogne, St. Cloud, Montmorency, Pré-Saint-Gervais, and Vincennes, are still under his consideration.

The lighting of the zone annexed, made under the special conditions with which you are acquainted, has given for the year 1865 the following results:—

| | | | |
|---|---|---|---|
| The portion of our works and of our canalization relating to this service represented on the 31st of December last . . . . . | £640,492 | 2 | 6 |
| The expenses incurred in 1865, calculated upon the bases agreed, amount to . . . . . | 42,399 | 10 | 8 |
| Capital on the 31st of December, 1865 . . . . . | £682,891 | 13 | 2 |
| During the year 1865 this account has been debited— | | | |
| First, with interest at 10 per cent. upon the capital expended before the 1st of January, 1864 . . . | £64,049 | 4 | 3 |
| Secondly, with interest at 10 per cent. to the 1st of July only, on the capital expended in the course of the year 1865 . . . . . | 2,119 | 19 | 6 |
| Thirdly, with the amount of 787,156,314 cubic feet of gas at the price of 3s. 2·055d. per 1000 cubic feet . | 124,814 | 10 | 11 |
| Total debit . . . . . | £190,983 | 14 | 8 |
| The credit is composed of the receipts arising from the sale of gas . . . . . | 178,761 | 3 | 6 |
| Leaving a loss in 1865 to be borne by the town of | £12,222 | 11 | 2 |

The account for the first five years of this lighting is as follows:—

| | | | |
|---|---|---|---|
| On the 1st of January, 1865, the town was indebted for this service in the sum of . . . . . | £37,729 | 17 | 3 |
| And interest on this sum at 6 per cent. . . . . | 2,263 | 15 | 10 |
| The balance in 1865 was . . . . . | 12,222 | 11 | 2 |
| The debit on compensation account to the 1st of January, 1865, was consequently . . . . . | £52,216 | 4 | 3 |

The preceding accounts have been admitted and agreed to conformably with the convention of 1861, by resolution of the Préfet of the Seine to the 1st of January, 1865.

Our labour in distillation is maintained within satisfactory conditions. We have, however, had occasion sensibly to augment the cost. We give monthly premiums to workmen who in the course of the month have not absented themselves without authorization. This has produced all the

results we expected, ensuring regularity of service in the manufacture, visible amelioration in the condition of the workman, who receives an increase of pay, and at the same time we have been relieved from the loss and expense consequent upon his absence from his work.

Although the winter has not been rigorous, our coke has found a ready sale. The product of it has amounted to £224,320 10s. 4d. On the 10th of March we had only 44 chaldrons in stock, notwithstanding a larger daily production this year than last of 68 chaldrons. The tar has produced this year £24,740 12s. 9d., and the chemical products £3566 2s., beyond the expense of purification, amounting to £5576 16s. 5d.

The favour accorded in previous years to our heating apparatus has been maintained.

| | |
|---|---|
| There were sold in 1865 . . . . . | 2,655 |
| The sale in previous years amounted to . . | 11,291 |
| Total . . . . . | 13,946 |

Our patterns have been imitated by many manufacturers, who have thus aided us in rendering them popular.

The use of Lenoir's gas-engine, which interests us as an apparatus consuming gas, continues to develop itself. On the 31st of December there was in use in Paris a total of 288 horse power of this system, consuming 20,342 cubic feet of gas per hour of work. The improvements which have been introduced within the last few years in the construction of this engine, have rendered it eminently suitable for numerous industries in Paris, whether continued or only intermittent action is required. This engine, put in motion or instantly stopped by the simple opening of a cock, consumes gas only when it is in actual use, and by this means adapts itself in the most economical manner possible to all exigencies of work. It acts without noise, and does not present the slightest inconvenience to the neighbours.

ABSTRACT OF WORKING ACCOUNTS.

EXPENSES.

| | | | |
|---|---|---|---|
| Manufacture— | | | |
| Materials distilled for the manufacture of gas . . . . . | £348,716 18 4 | | |
| Coke, coal, &c., for heating the furnaces . . . . . | 90,110 18 10 | | |
| Gas in store on Jan. 1, 1864 . . . | 236 4 9 | | |
| Carrying on the works— | | £439,064 | 1 11 |
| Salaries and labour . . . . . | £50,791 16 9 | | |
| Repairs of works, furnaces, and retorts | 37,666 5 7 | | |
| Expenses necessary to the distillation and purification . . . . . | 28,211 16 3 | | |
| Out-door expenses— | | 116,669 | 18 7 |
| Salaries of engineers and agents . . | 19,899 11 3 | | |
| Repairs of mains . . . . . | 22,615 14 5 | | |
| Law expenses, printing, &c. . . . | 5,293 8 6 | | |
| Central administration— | | 47,808 | 14 2 |
| Council of administration . . . . | 5,590 1 1 | | |
| Salaries . . . . . | 21,121 16 7 | | |
| Office expenses, fire, accidents, gratuities, &c. . . . . | 6,353 12 2 | | |
| Rent and insurance . . . . . | 5,139 19 4 | | |
| Interest on debentures . . . . . | 55,150 8 10 | | |
| Surveys and experiments . . . . | 5,037 18 5 | | |
| Cashier's expenses . . . . . | 2,046 15 11 | | |
| Benefit and annuity fund . . . . | 3,417 1 9 | | |
| Municipal charges— | | 103,857 | 14 1 |
| Duty on gas . . . . . | 81,008 17 6 | | |
| Rent payable for use of subsoil . . | 8,000 0 0 | | |
| Lighting, extinguishing, and repairs of apparatus for the public lights, after deducting the indemnity paid by the town . . . . . | 13,873 13 11 | | |
| Government charges— | | 102,882 | 11 5 |
| Taxes . . . . . | 6,406 8 4 | | |
| Subsidies . . . . . | 320 0 0 | | |
| Stamps . . . . . | 2,171 15 9 | | |
| | | 8,898 | 4 1 |
| Total expenditure . . . . . | | £819,181 | 4 3 |

INCOME.

| | | | |
|---|---|---|---|
| The total product of the sale of gas amounts to . . . . . | £1,133,966 16 7 | | |
| Gas in store on Jan. 1, 1865 . . . . | 500 2 0 | | |
| Retort coke . . . . . | 292,755 12 8 | | |
| Oven coke . . . . . | 24,745 17 0 | | |
| Tar . . . . . | 24,743 0 9 | | |
| Rent of meters and service-pipes, repairs of cocks, &c. . . . . | 33,214 16 0 | | |
| Profit on fire-brick manufactory . . | 8,430 16 0 | | |
| Do. on manufacture of chemical products . . . . . | 3,566 2 0 | | |
| Sundry works . . . . . | 1,035 10 1 | | |
| Interest and discounts . . . . . | 22,635 11 6 | | |
| Compensation account for balance of loss in the supply of gas in the zone annexed . . . . . | 12,222 12 9 | | |
| Heating apparatus . . . . . | 994 3 11 | | |
| | | 1,558,811 | 1 3 |
| The expenses amounting to . . . . . | | 819,181 | 4 3 |
| The profits of the working for 1865 are therefore . . | | £739,629 | 16 0 |
| Balance brought forward from previous years . . . | | 347 | 14 0 |
| Total to carry forward . . . . | | £739,977 | 10 0 |
| We propose to you, gentlemen, to fix the dividends at £4 4s. per share. We paid you in October last, on account, £1 per share on 168,000 shares . . . . . | 168,000 0 0 | | |
| The balance to be paid on the 7th of April next, of £3 4s. per share, being . . . . . | 537,600 0 0 | | |
| makes . . . . . | | 705,600 | 0 0 |
| and leaves the surplus to be carried forward . . | | £34,377 | 10 0 |

You have seen that the profits of the last year amounted to . . . . . £739,629 16 0
and those of the year 1864 to . . . . . 693,467 0 10

The difference in the net profit of 1865 being therefore . £46,162 15 2

Notwithstanding, gentlemen, we have not thought it our duty to propose to you this year an increase upon the amount of dividend paid last year. The moment appears to us to be come for augmenting progressively the amount of our reserve-fund, and we propose to you this augumentation with all the less regret, seeing that at the epoch when the town will enter into possession of its right to share the profit, the company will be happy to possess an important reserve, and to be able thus to compensate in a certain measure the part of the profit which this division will take from us.

The working accounts, of which we have now given you an abstract, have been verified, as has been our custom, by two members of the Council of Administration deputed for that purpose, and afterwards by your commission for the verification of these accounts.

The sale of the lands belonging to the old works at Trudaine approaches its end. We hope to be in a position speedily to liquidate this operation. Upon those of the old works, De la Tour, Quai de Valmy, we have also sold a considerable part of the land, and we shall soon receive a payment which will reduce to about £56,000 the balance remaining due upon this property. The lands belonging to the old works of the Faubourg Poissonniere, and the house that we possess at the Rue de Bellefond, deducting those reserved for the hotel of the company, and the workshops and houses in front of the hotel, have been sold this year for the sum of £137,280, upon which a first payment of £32,000 has been made. A second payment will take place at the end of the month. It only remains for us to terminate this important operation in land by realizing some parcels of relatively little extent, but having still considerable value. The credit balance of landed property to realize which figures in the balance-sheet for £45,737 14s. 2d. represents the excess of the profits obtained upon the sale of lands beyond their first valuation. The definitive results of this account will be presented to you in the next balance-sheet, but we are now enabled to state that the actual provisional balance is augmented by the land not yet realized, and of which the amount will, without doubt, exceed the estimated price, which is £19,532. The view must not be lost sight of, that, in the realizations which have taken place, the undertaking has entered integrally into the interest of the capital which has been represented by our landed property.

The benefit-fund continues its operations. It fulfils the object which the council had in creating it. During the year 1865, in consequence of the invasion of the cholera, the number of sick was considerably augmented. Of these 1368 patients were visited at their own homes, and twice that number consulted the medical officers of the company. The expenses of this service, as well for the medical staff as for the medicines and surgical appliances, payment of half wages, burial expenses, &c., amounted to £5185 8s. 9d. The receipts produced £5163 4s. 3d., so that the excess of expenditure over receipts was £22 4s. 6d. The credit balance of the fund on the 31st of December last was £3074 10s. 1d. In case of illness or serious injuries contracted in the service of the company, the directors have been authorized to pay the wages and salaries in full, the fund contributing only one-half. This favour is only granted to those who have merited it by their good and long services.

The annuity-fund possessed on the 31st of December, 1865, the sum of £12,904 15s. 4d. The regulations permit to draw upon the actual endowment of this fund a sum of £180 for the granting of assistance to old *employés* of the company who have become incapable of fulfilling their functions. Not only are we obliged to appropriate the whole of this sum integrally, but to add to it still a supplementary subvention voted by the council every year.

You authorized last year the issue of 32,000 debentures. The first half offered to the shareholders was subscribed immediately. As the works on capital account which we foresee necessary for this year will cause an expenditure exceeding our disposable resources, we have thought it advisable to issue the remainder of these obligations, and to reserve the subscription by preference to the shareholders on the same conditions as last year—that is to say, at the price of £18, payable in two instalments, viz., £10 on the 1st of April next, and £8 on the 1st of October following, the debentures receiving interest from the 1st of January, 1866.

## THE LONDON WATER SUPPLY.

[From the *Supplement to the Registrar-General's Weekly Return.*]

London is divided into fields among the water companies; the Chelsea Company, the Grand Junction, and the West Middlesex have the west districts; the Southwark, the Lambeth, and the Kent Companies have the south districts for their respective domains. Out of 10,000 inhabitants in each of these fields six deaths occurred in seven weeks from cholera and diarrhœa, and the proportion in all the other fields except one is nearly the same.

The New River Company supplies nine north and central districts from the river Lea* and from springs; the deaths by cholera and diarrhœa out of 10,000 inhabitants in these districts were nearly 8.

The East London Company supplies six districts with the waters of the Lea, and the deaths out of every 10,000 inhabitants were 79; or, without calculation, the deaths were 415 out of 536,576 inhabitants supplied by the New River; the deaths were 3721 out of 471,109 inhabitants supplied by the East London Company. The two companies are neighbours, and take their waters from the same Lea River.

Hackney, Shoreditch, and the East London Union are jointly supplied by the two companies; the deaths by cholera and diarrhœa were 10 in 10,000 inhabitants. But the East London Company sends water to these districts chiefly from Lea Bridge; and, strange to say, only its waters from the Old Ford reservoirs, two miles down, have gone to the fatal districts. Every district to which these waters have gone has suffered in an extraordinary degree; the other districts have not suffered to a tenth of the extent.

It is of such vital importance to determine accurately the exact operation of the water in causing so many deaths, that Dr. Frankland has been requested to make a careful analysis of the East London water in the various reservoirs. This he has done, and briefly described the works in a very able paper.

Underground hydraulic works cannot be easily inspected, and still less easily described; much less can their operations and the flow of their waters in past months be now learnt. Mr. Greaves alone can write the history of these eventful weeks.

But nearly all that is really essential can be learnt from the papers in the

* 82 per cent. of their water in 1865 was drawn from the Lea. (Appendix to First Report of Commission on Pollution of Rivers, p. 37.)

appendix. The Lea is formed by the confluence of five or six streams in Hertfordshire; divides Middlesex from Essex, and empties its residual waters into the Thames at Barking Creek. At Lea Bridge the East London Company has its 13 filter-beds in two groups, one on each side of the Lea; they are fed by an open aqueduct which carries down the water two or three miles after it has passed through subsidence beds. In ordinary circumstances a part of this filtered water is distributed directly from Lea Bridge over "Tottenham, Hackney, Shoreditch, Haggerston, during the day, and the whole of the company's district during the night;" here cholera in the parts north of Victoria Park was not fatal. The rest of the water is conveyed down two miles or more of a large iron main to Old Ford, where it is lodged in a small covered underground reservoir for distribution by three powerful pumping-engines; the pipes of Old Ford inosculating freely with those of Lea Bridge, the water system in the pipes sways backwards and forwards at their juncture, according as the water above or below prevails.

What resource has the engineer if the filter-beds in July refuse to act, or if, as lately happened to the New River, a main bursts, or if any accident happens to the complicated apparatus? This has to some extent been provided against. The waters of the aqueduct at Lea Bridge can be passed directly without filtration into the main; and as the waters from the filter-beds at Lea Bridge are carried down the company's canal to two large open reservoirs of 9 acres at Old Ford, the water of these reservoirs can be used, as they can at once be thrown in any quantity into the pumping-wells.

The bottoms of all the Old Ford reservoirs are much below the dirty sewage waters of the Lea at Trinity high-water mark; and Dr. Frankland shows the possibility of the accidental contamination of the waters of the covered reservoir. It is evidently as difficult to obviate this evil as to keep the upper waters of the Lea perfectly free from sewage like that which infests the Thames.

There is another hypothesis. During certain days of June or July, perhaps in the absence of the engineer, there was a hitch in the supply; and the waters of the two open, almost stagnant reservoirs, one filled by soakage in part from the Lea, were mixed with the comparatively purer water in the mains of the company. This hypothesis is in accordance with all the known facts, and with the circumstance that the cholera began to subside in all his districts immediately after the engineer's attention had been directed to the dangerous state of the waters. If this hypothesis is rejected, the company can exercise no immediate control over its supply.

The East London Company is in the condition of a grand hotel which has one small cellar of good wine and two of bad vintages, which, as in the words of its manager, it never uses "except in cases of emergency," its customers would be pleased to learn were suppressed.

The open reservoirs near the Lea, in communication with the pumps of supply at Old Ford, are a public danger, not only to the population that has been decimated in the east, but to the population of all London, for the diseases they engender spread like fire. The reservoirs, as well as the canal, should be abolished, and the water be stored somewhere else in safety.

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### Dr. Frankland's Report.

*Royal College of Chemistry, Aug.* 25, 1866.

Sir,—At your request I have made a careful inspection of the water-works of the East London Company, and, in addition to my usual monthly analysis of the water as delivered to consumers, I have collected and analyzed various samples taken, on the 9th inst., from the company's reservoirs, consumers cisterns, and the river Lea. In this inspection I have been assisted by Mr. Valentin, of this college, whose valuable aid, promptly and willingly given, I have much pleasure in here acknowledging.

The whole of the company's works at Lea Bridge and at Old Ford were inspected on two separate days—viz., on the 9th and on the 23rd inst., but, as everything was in the same condition on the two occasions, it will not be necessary to describe the visits separately. On both occasions Mr. Greaves, the company's engineer, and Mr. Maine, the manager of the works at Lea Bridge, gave, in the most courteous manner, every facility for the inspection of the reservoirs, filter-beds, and machinery, and furnished, frankly and unreservedly, all the information asked for.

At Lea Bridge I found the water being brought to the company's premises by a special open canal leaving the river Lea at Tottenham Mills, above the great sewage contaminations of the river, but below the outfall of the sewage from Hertford and Ware. I was informed by Mr. Maine that the sewage of the former town is deodorized by lime, and then filtered before it flows into the river, but that the sewage of Ware enters the Lea without undergoing any purifying process.

The company's premises at Lea Bridge are chiefly devoted to filtration, but there is also a magnificent pumping-engine which raises and delivers a portion of the day supply and the whole of the night supply of the East London Company. There is no storeage reservoir upon these premises, the whole of the water not raised by the pumping-engine being transmitted as fast as it runs from the filter-beds through a closed conduit down to a covered storeage reservoir at Old Ford. There are 13 large filtering reservoirs at the Lea Bridge works. The area which they occupy is bisected by the river Lea, with which, however, the reservoirs have here no connexion. The filtering apparatus is of the most approved construction, and the filtered water is delivered into the so-called Essex and Middlesex wells, situate respectively on the right and left banks of the river Lea, in a condition of transparency, leaving nothing to be desired in this respect. In fact, so far as the removal of mechanically suspended matters from the water is concerned, the result could not possibly be better.

The upper stratum of fine sand forming the floor of these reservoirs, and through which the water filters, requires frequent removal and cleansing, so that one or two of the reservoirs are usually empty and undergoing this operation. Mr. Maine told me that the rapidity of filtration from these reservoirs is very variable, and that in the month of July in every year a slimy matter very rapidly deposits upon the sand, blocking up its pores, and stopping the filtration altogether. In the month of August (according to Mr. Maine's clear and intelligent description) this slimy matter begins to grow, producing green confervoid fibres, such as I saw on the 23rd inst. in the water of the filtering reservoirs, and especially upon the surface of the sand of one of them which was being cleaned. As soon as the confervoid growth begins, the filtering power of the reservoirs is entirely restored; but during the month of July, while the slimy matter continues to be deposited, the work of filtration is always, as Mr. Maine informed me, attended with great difficulties.

There are two provisions at the Lea Bridge works by which water from the special canal above mentioned can be transmitted without filtration to the storeage reservoirs at Old Ford. One of these is an iron main at the canal head communicating with the main used for transmitting filtered water, and the other an open conduit or canal, formerly used to convey the whole of the water from Lea Bridge to Old Ford. From the condition of the sluice closing the iron main, I am convinced that no unfiltered water has been transmitted through that main for some months past. On the other hand, unfiltered water is frequently transmitted to Old Ford through the open conduit, for into this conduit the water from the filtering reservoirs is discharged whenever the latter require cleansing. It is scarcely necessary to remark that the water so discharged from the blocked-up filters is far more impure than the unfiltered water from the special canal, because the lighter portions of the suspended matter, from large volumes of water which have passed through the filter, are here concentrated in a comparatively small bulk, and as the open conduit down to Old Ford has much organic mud and slime in its bed, the water so transmitted down to Old Ford must be exceedingly impure when it arrrives there. At Old Ford lock there is an overflow-pipe which conveys this water into the river Lea; but there is also at the same place a sluice through which this water can be admitted into the uncovered reservoirs. From the nature of the mud deposited in these uncovered reservoirs I am inclined to believe that this water is sometimes admitted into them. Both Mr. Greaves and Mr. Maine assured me that no unfiltered water is ever now transmitted from Lea Bridge to Old Ford for the supply of the public.

The Old Ford works may be described as a storeage and pumping station, no filtering or purifying operations being here performed. There is a covered reservoir 2½ acres in extent, capable of containing water to the depth of 10 feet 6 inches, and when full the surface of the water is about 6 feet below the general level of the ground. Mr. Greaves informed me that, when the reservoir is filled to its highest point, the surface of the water is at the level of Trinity high-water mark. From this covered reservoir the water is supplied to the public by three pumping-engines, which furnish the greater part of the day supply of the East London Company. I observed fish of three or four inches in length swimming about in this reservoir. As already mentioned, there is a direct delivery to the public from Lea Bridge, which supplies Shoreditch, Hackney, Haggerston, and Tottenham during the day, and the whole of the company's district during the night; but, inasmuch as there is free communication between the branch mains of the Lea Bridge and Old Ford systems, there in no sharp line of demarcation between the two supplies. I was informed, however, that owing to the hydraulic conditions of the two pumping-stations, the above-mentioned districts would be mainly supplied from Lea Bridge. The rest of the East London Company's district would chiefly receive its day supply from Old Ford reservoir; while Stamford Hill is always, on account of its elevation, specially supplied from Old Ford.

Along one side of the covered storeage reservoir at the latter station, and within a few yards of it, runs the navigation branch of the river Lea, the water of which stands at about the same level as the water in the reservoir when the latter is completely filled. Pending the completion of the main drainage works, this branch of the river receives much of the sewage of the surrounding district, and, being nearly stagnant, it is in a most offensive condition; in fact, it is here little better than an open cesspool. A sample of the river water was taken at this point on the 9th inst., but the river had been flushed out at low water two days previously, by which its condition had been greatly improved. The sample analyzed, bad as it is, does not therefore represent the quality of the river water at this point in what may be called its normal condition of filthiness.

On the opposite bank of the river are the two large uncovered reservoirs of which mention has already been made. These reservoirs have a considerable deposit of mud, which is not, however, putrescent. One was full, and the other partially empty; the latter, as I was informed, was being emptied by pumping into the Lea. Communication can be established between these reservoirs and the pumping-wells supplying the public, but Mr. Greaves assured me that it was never done, except in case of emergency. It was not done in the event of a fire, but he wished to retain the power of having recourse to these reservoirs in case of defective supply from the filtering apparatus at Lea Bridge. These reservoirs, as I am informed by Mr. Greaves, are excavated in gravel; they are consequently doubtless subject to considerable soakage, both from the river Lea, the surface drainage, and the sewage which here saturates the soil.

A comparison of the results yielded by the water from the canal at Lea Bridge with those obtained with the same water taken from the Essex well, after filtration, shows the important extent to which the water is purified by passage through the filtering reservoirs. The substitution of unfiltered for filtered water would at once increase the organic matter supplied to consumers to the extent of 43 per cent. With the exception of the dirty sample drawn from the company's main at Stewart's Buildings, and which contained the same amount of organic impurity as the water of the uncovered south reservoir at Old Ford, none of the samples of water upon the company's premises exhibit, in comparison with the Thames water supplied to the metropolis, any excessive amount of impurity; but, as I have already pointed out in a previous report, chemical analysis, like every other mode of investigation, is powerless to detect the presence of matter like the choleraic poison among the organic impurities of water, for this poison may be present in quantity fatal to the consumer, though far too minute to be detected by the most delicate chemical research. Further, when water has once become polluted by such matter, we possess no certain means of a practical character for destroying or rendering innocuous the poisonous matter. I have conclusive evidence that even boiling, which is generally regarded as the most efficacious means, will not prevent water which is so contaminated from producing violent cramp and diarrhœa.* The use of the permanganate of potash or of animal charcoal, in the manner I have already recommended, is the only practicable means in which I should have much confidence for the removal of such noxious matters from water.

This impossibility of proving either the presence or absence of choleraic and other allied poisons in water, and the uncertainty of all processes for their removal, renders it the more important to guard with the most scrupulous care against the possibility of such contamination. It is precisely at this point that the otherwise excellent arrangements of the East London Company appear to me to exhibit some grave defects. I do not specially allude to the admission of the sewage of Hertford and Ware to the river Lea at a point above that whence the water supply is drawn, because this defect, though a serious one, is common to the Lea water and to the supplies drawn from the Thames; it is, in fact, an evil which cannot be avoided so long as we are content to obtain from rivers the water which we use for domestic purposes; but my remark applies to the retention of the means of supplying unfiltered and impure water at Old Ford station, and especially to the position of the covered storeage reservoir at the same station from which the chief part of the daily supply is now drawn. I was astonished to find that the water, after being carefully brought down from

* This fact is not incompatible with the theory that choleraic and similar poisons are the germs of organisms, for it is well known that certain organic germs can develop into life after being boiled in water for a short time.

Tottenham Mills in a special canal, purified by a most elaborate and efficient system of filtration at Lea Bridge, and then, to secure it from atmospheric impurities, conveyed in an iron main down to Old Ford, is stored in a reservoir sunk to the depth of some 16 feet beneath the low ground, which is here only just above the level of spring tides, and that when the reservoir is full the level of the surface of the water in it only reaches that of Trinity high-water mark. This reservoir, as I was informed, is excavated in clay, but the side next to the navigation branch of the foul river Lea is of gravel. No doubt this is well puddled, and the brickwork sides executed in the best possible manner; nevertheless, the position of this reservoir, with its 2½ acres of floor 16 feet below the surface of a badly-drained district, is fraught with much peril during the prevalence of epidemic disease. Whatever precautions may have been taken, soakage to some extent must take place into such an excavation, and it was stated to me that when the reservoir is emptied, such soakage water, though not in large quantity, has to be removed by pumping.

Such being the conditions of storeage, the application of any temporary remedy is obviously surrounded with formidable difficulties. I satisfied myself that filtration through coarse animal charcoal could easily be applied in the Essex and Middlesex wells at Lea Bridge to the whole of the water supplied by the company; but there would be little use in thus purifying the water at Lea Bridge when it has afterwards to be stored in the reservoir at Old Ford. It is only by passage through animal charcoal, as the water leaves this reservoir, that the advantages of the charcoal could be secured. Owing to the construction of the works at Old Ford, I was unable myself to form an opinion as to the possibility of such a filtration being carried out there at a short notice. Mr. Maine thought it could be accomplished without difficulty; but Mr. Greaves, who is much more likely to know, was of a totally different opinion, and thought that such a filtration could not be effectively carried out at Old Ford without the construction of new apparatus, which would require too much time to render it available during the present emergency. It is to be hoped, however, that means may be taken, without delay, either to alter the place of storeage, or to render practicable filtration through animal charcoal immediately before the water is supplied to consumers. I have, &c.,

The Registrar-General. E. FRANKLAND.

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The Registrar-General has received the following additional letter from Professor Frankland:—

"*Royal College of Chemistry, Oxford Street, Sept. 8.*

"Sir,—In my report to you upon the water supply of the East London Company, dated August 25, I stated that boiling will not prevent water which is contaminated with poisonous excrementitious matter from producing violent cramp and diarrhœa. The case upon which I founded this opinion is the following:—A gentleman and his wife partook of tea made with well water, which was poured boiling from the tea-kettle into the tea-pot. Between three and four hours after partaking of the tea, and after they had been asleep for some time, they were both awoke by violent cramps, both in the limbs and body, which were soon followed by excessive diarrhœa. The cramps lasted for several hours, and the diarrhœa until the following afternoon. Both patients were affected in exactly the same way. The well water was suspected, and the well, which was a very shallow one in slate rock, was at once opened and examined. It was soon found that a pipe from a water-closet had burst, and that some of the contents had made their way into the well; in fact, some fragments of excrementitious matter were found floating on the surface of the water. The water from this well was never again used, for the well was filled up, and another excavated at some distance, and the symptoms, which were entirely novel to the patients, never again occurred.

"The attack took place in a very healthy locality in the country, and at a time when no epidemic diarrhœa or cholera prevailed. Were such an experiment tried now, the result can scarcely be doubted. I am intimately acquainted with the sufferers, and was at once informed of all the circumstances. The evidence afforded by this case is exceptionally conclusive—first, because the parties never, under any circumstances, drank this water except in the form of tea or coffee; and, secondly, because they were at the time the only inmates of the house, being without a servant; there can, therefore, be no doubt about the water having been boiled. The case excited my special interest on account of the unexpected conclusion to which it leads; and I mention it because it is important, at the present juncture, that we should not place implicit reliance upon a precautionary measure founded upon the assumption that the noxious qualities of the organic matters of sewage are destroyed by boiling.

"I have, &c.,

"The Registrar-General." "E. FRANKLAND.

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## GAS AND WATER SUPPLY AT CANTERBURY.

It will be in the remembrance of our readers that the grievances long borne by the gas consumers of Canterbury culminated in the starting, about a year ago, of a new company. Shares were freely taken by the gas consuming public, and the scheme promised to be a successful one. It was at this point that the directors of the old company stepped in, with offers to make certain important concessions. One of these was the important change in the price of gas from 5s. 6d. to 4s. per 1000, to take effect some few months after the proposal was made. Such overtures as these, however, void as they were of any pledge that *permanent* benefit would accrue, could not be received by the consumers of gas. It was now that the conferences were held between the old and new directors, which led to the former offering to apply to Parliament for increased powers to enable them to adequately supply the city with gas and water; and these terms, on being submitted to the shareholders in the new concern, were considered fair and reasonable, and accepted. Accordingly, in the last session of Parliament the old company obtained a bill (the 19th and 20th Vic.) authorizing them to increase their capital, enlarge their works, and reconstruct the system of water supply. The bill provided that 600 shares of £10 each should be open to the gas consumers of the city, whose interests at the board of direction should be represented by four new directors named in the bill—viz., Messrs. Marten (mayor, and chairman of the new Gas Consumers Company), N. Jacobs, P. Higham, and T. W. Collard. Hence a few days ago a meeting was called to dissolve the new company, but it was found that considerable apathy existed among the gas consuming public, now that their requirements had been met, in taking up the new capital. An appeal, however, was issued by the mayor of the city, in which he stated that the Gas Consumers Company having achieved the object for which it was associated, in reducing the price of gas to 4s. per 1000 feet, and thus effected a considerable saving to consumers, it called upon them to successfully carry out the struggle by taking up the shares in the new capital of the Canterbury Gas Company, and thus qualify themselves to return directors to the board who would not only preserve to them the advantages already obtained, but also promote other improvements in the manufacture and supply of the essential article of gas. The result of this is, that the whole of the additional capital has been subscribed for by those who it was desired should have an interest in the concern—the gas consumers—and thus it is to be hoped that the vexed question has at last been satisfactorily and permanently settled. A hope is generally entertained by the gas consumers that the first act of the new direction will be to take the management of the works out of the hands of contractors as speedily as possible, and thereby make themselves responsible to those who elect them for carrying out the arrangements entered into.

The matter of water supply is now under discussion. Since the introduction of the Local Government Act in Canterbury, it has transpired that a large proportion of the water obtained from private sources is wholly unfit for use; and that to remedy this evil a vast quantity of water will have to be brought into the city either by the gas and water company or by the local government authorities. The cost of this is estimated at £40,000—a sum which it is reasonable to suppose cannot be raised by the company. The undertaking will, therefore, have to be conducted by the local body. Within these last few days a notice has been served on the gas and water company, desiring them to comply with the wants of the inhabitants in the matter of an ample supply of good and pure water; a request, however, it is impossible for them to carry out. Pending the action which must be taken, the local board have tested a spring called "Silver Hole," situate at Whitehall, about one mile from the heart of the city. It has been ascertained that from this source a daily supply of 690,000 gallons of excellent water, or about 34 gallons to each head of the population, can be obtained, and this no doubt will shortly be available to the citizens.

With good gas, capital water, and first-class drainage (for an entirely new system of drainage is in projection), the old city of Canterbury will enjoy an immunity with which even some modern towns are not blessed.

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## ON THE NATURAL AND ARTIFICIAL PRODUCTION OF THE DIAMOND.

By M. CHANCOURTOIS.

[Translated from the *Mémoire* in the *Comptes Rendus de l'Académie des Sciences*, July 2, 1866.*]

Not being able yet to publish the whole of the conclusions of the *mémoire* on the co-ordination of the sources of petroleum and of bituminous deposits, of which I presented the first parts in 1863 (*Comptes Rendus*, August 17 and 24, and November 2), I desire to claim priority with respect to certain points, and principally with respect to the following proposition:—"The diamond is derived from hydrocarbonic emanations, as sulphur is derived from hydrosulphuric emanations."

It is known that the crystalized sulphur of the "solfataras" results from the demi-oxidation of the sulphuretted hydrogen traversing the fissures, or through the spongy tufas, in contact with the air of the atmosphere, or with the air dissolved in the superficial waters. All the hydrogen is oxidated; but in the conditions of the problem that may be called the humid combustion, a part of the sulphur only passes into the state of sulphurous acid, the rest deposits itself by crystallizing more or less completely. I think that the cubon of diamond is isolated in the same manner, in the humid combustion of a carburetted hydrogen, or a carbide of hydrogen, in which all the hydrogen should be oxidized, whilst a part only of the carbon should be converted into carbonic acid.

The theory that I propose is quite in accordance with the most generally received opinion that places the ordinary source of the diamond in the "itacolmnites," and in the ferruginous sandstones that are of the dates of the Devonian series at least; for, on the one hand, this period belongs to that of the phase of the eruption of great crystallization; and, on the other, the abundance of the bituminous impregnations in it marks the maximum of the hydrocarbons, that is, the precursor or the original cause of the excess of the carbonic acid of the atmosphere, to which is due the vegetation of the coal period that followed the period referred to. This theory is in nowise in contradiction with the recent discovery of traces of vegetable organizations in the interior of diamonds; for, according to the laws of mineralization, we ought to find that the crystallization of the carbon liberated should have been determined about the signs of vegetable life, particularly if we take into account the probably very simple character of the primitive vegetation, and if we reflect upon the possible production of the vegetable substance by the concomitant production of the carbonic acid. Now that industry can extract from petroleum all the colours of the rainbow, and particularly the moving colours of the diamond, it may be cited as a proof of the hypothesis which connects the diamond with the carburets of hydrogen.

It must always be observed that the opinion which places the formation of the diamond at the epoch that is most bituminous, does not imply that this formation had taken place at all situations where the hydrocarbon products were most abundant. The diamond could, on the contrary, only be formed there where the fissures of the earth's crust should permit the escape of the carburetted hydrogen, or the carburets of hydrogen in the state of vapour, and, even without doubt, very slowly, inasmuch as slowness is one of the conditions that are necessary for the fine crystallizations of which the diamond furnishes the prototype. The petroleums have also been subjected to an imperfect oxidation, but the carbon, isolated chemically by the reaction, far from crystallizing, remains engaged with the excess of petroleum. It is thus that have been formed, and are even now forming, the bitumens, those substances that are viscous above all others, in which the carbon, being seized in the nascent state, appears to remain in dissolution—that is to say, in the condition of a liquid, but yet communicating to its dissolvent a viscosity that reminds one how much the liquid state is opposed to its nature. The massive graphite, which serves for the manufacture of pencils, is, so to speak, the result of the evaporation of this solution. Its aspect shows that the carbon has been deposed in small particles by the retreat of the liquor, whose last particles have been then expressed mechanically.

I can now express another *résumé* of my theory by the aid of a name that should distinguish all the deposits of pure carbon by the designation of "carbonator." The deposits of graphite and of diamond would be the *carbonator*, which would occupy the same place in the earlier formations that the *solfataras* do in the recent ones, with the difference in their deposit which would correspond with the conditions of their systems of eruption and sedimentation. Their lines of direction, for instance, might be more precise in detail, more crossed in the mass.

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* This *mémoire* was read in the sitting of the Academy of June 25, but it excited so much apprehension on the part of the authorities of the Academy, on account of the novelty of the views contained in it, that it was not considered prudent to publish it until it had received the sanction at least of M. Pelouzé's opinion in favour of the probability of the theory upon which it was based. It is given *quantum valeat*.

I arrive, at last, at a theoretical consideration to which I attach the highest importance.

The number of the molecular weight, that which I call the numerical characteristic of carbonic acid, $CO^2$, is $12 + 2 \times 16 = 44$. This number coincides precisely with the thermic number that the characteristic number above given would furnish, or, to speak more precisely, with that of the diamond. Is not this a confirmation of the hypothesis according to which two bodies of the same numerical character are produced under parallel circumstances?

I ask permission to be allowed to state that the numbers adopted for the new atomic weights in a modern *résumé* of chemical philosophy, whose authority has been justly recognized by a high reward, fall, with the exception of that of vanidium, into the limits of oscillation that I have assigned to the numerical characteristics in my classification of the bodies that are simple or radical, which I presented under the title of Telluric Force. (See the *Comptes Rendus de l'Académie des Sciences* of April 7 and 21, May 5, Oct. 13, 1862, and March 16, 1863.) The geological considerations have, then, guided me very surely; at least as to the choice I ought to have made between the various multiples and submultiples which the different systems would place in competition, and which had not failed to produce the greatest confusion. I hope to see my conclusions will be confirmed in other respects.

I return to the subject of this note. The artificial production of the diamond has been the object of numerous efforts, but I do not know that it has been tried in the way I have indicated in my geological analysis. The preliminary steps of the process seem to me very simple; they would consist in exposing a very slow current of carburetted hydrogen, or of the vapour of the carbide of hydrogen mixed with the vapour of water, to an action of oxygenation of a very mild nature, in a mass of sand, containing some traces of putrescible matter—as, for instance, a little flour. I would fear to go beyond the sphere of action of a geologist, if I were to develop to a greater extent these experimental indications. I should, however, come nearer to the strict limits of my profession if I indicated the possible existence of a new source of diamonds, which might be at least of an artificial origin.

Do not the escapes that take place from gas-pipes offer great analogies with the natural sources of gas, or the hydrocarburetted vapours? and would it not be possible that the artificial production of the diamond has already been realized in some of the black earth that we see every day extracted from our streets?

It would, at least, furnish a certain chance of finding the powder of the diamond, which would be of immense importance in the arts at the present time, inasmuch as it is the material that is capable of cutting and polishing everything.

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COMPOSITION AND QUALITY OF THE METROPOLITAN WATERS, IN AUGUST, 1866.—The following are the returns of the Metropolitan Association of Medical Officers of Health:—

| Names of Water Companies. | Tot. solid Matter per gal. | Loss by Ignition* | Oxidizable Organic Matter.† | Hardness. | |
|---|---|---|---|---|---|
| | | | | Before Boiling. | After Boiling. |
| *Thames Water Companies.* | Grains. | Grains. | Grains. | Degrees. | Degrees. |
| Grand Junction | 18·31 | 0·81 | 0·60 | 13·5 | 4·0 |
| West Middlesex | 16·80 | 0·59 | 0·48 | 13·0 | 3·5 |
| Southwark and Vauxhall | 18·67 | 1·00 | 0·64 | 14·0 | 3·5 |
| Chelsea | 11·43 | 0·65 | 0·56 | 13·0 | 3·5 |
| Lambeth | Not received. | | | | |
| *Other Companies.* | | | | | |
| Kent | 27·36 | 0·70 | 0·63 | 17·5 | 8·5 |
| New River | 17·09 | 0·54 | 0·22 | 13·0 | 3·5 |
| East London | 18·19 | 0·88 | 0·56 | 13·0 | 4·0 |

HY. LETHEBY, M.B.

* The loss by ignition represents a variety of volatile matters, as well as organic matter, as ammoniacal salts, moisture, and the volatile constituents of nitrates and nitrites.

† The oxidizable organic matter is determined by a standard solution of permanganate of potash—the available oxygen of which is to the organic matter as 1 is to 8; and the results are controlled by the examination of the colour of the water when seen through a glass tube two feet in length and two inches in diameter.

All the samples of metropolitan waters received during the month have been remarkably bright and free from colour; and the proportion of organic matter has not in any case exceeded 0·7 of a grain per imperial gallon, while in the East London water it was very little more than half a grain per gallon, and in the Kent water it was only 0·03 of a grain per gallon. The total amount of saline matter in the water derived from the Thames is a little more than it was last month, but that of the other companies has been a little less.

ANALYSIS OF THE METROPOLITAN WATERS FOR AUGUST, 1866, BY PROFESSOR FRANKLAND, F.R.S., OF THE ROYAL COLLEGE OF CHEMISTRY:—

| Names of Water Companies. | Number of Houses supplied in July, 1866. | Average daily Supply of Water in Gallons during Month of July, 1866. (See note.) | Solid Matter in 100,000 part of the Waters. | Organic and other Volatile Matter included in column 4. | Amount of Oxygen required for oxidation of Organic Matter. | Tote Hardness.* |
|---|---|---|---|---|---|---|
| *Thames Water Companies.* | | | | | | |
| Chelsea | 26,463 | 8,671,600 | 24·89 | 1·29 | ·0344 | 17·4 |
| West Middlesex | 36,000 | 9,090,414 | 23·62 | 1·16 | ·0304 | 16·2 |
| Southwark and Vauxhall | 73,857 | 12,180,000 | 23·66 | 0·98 | ·0336 | 16·2 |
| Grand Junction | 25,636 | 9,800,484 | 25·00 | 1·09 | ·0368 | 16·8 |
| Lambeth | 36,374 | 9,907,400 | 25·51 | 1·53 | ·0368 | 17·2 |
| *Other Sources.* | | | | | | |
| Kent | 33,162 | 6,791,427 | 38·88 | 1·80 | ·0084 | 24·8 |
| New River | 112,245 | 25,812,000 | 20·20 | 0·89 | ·0133 | 13·7 |
| East London | 90,174 | 20,524,883 | 26·14 | 1·44 | ·0328 | 17·7 |
| South Essex | +750 | +160,000 | 38·04 | 1·80 | ·0108 | 22·2 |

* The degree of hardness hitherto employed by chemists is that first proposed by Dr. T. Clark—viz., one grain of carbonate of lime, or its equivalent of hardening salts, in one imperial gallon of water, or one part in 70,000. The degrees of hardness used in the above table are readily converted into Clark's degrees by multiplying by seven, and then moving the decimal point one place to the right.

+ No return has been received from the South Essex Company for the month of July. The numbers inserted above for this company are the same as those returned for June, no alteration having occurred in the number of houses supplied, or in the average daily supply of water during the previous four months.

*Note.*—The water includes the supply for manufactures and for various purposes other than domestic consumption. This return, as compared with that for the previous month, shows an increase of 2948 houses and an increase of 6,365,826 gallons of water supplied daily. The table may be read thus:—100,000 lbs. of the Chelsea water contained 24·89 lbs. of solid matter, of which 1·29 lb. of organic and other volatile matters was driven off by incineration. 0·0344 lb. of oxygen was required to oxidize the organic matter in the said quantity of Chelsea water. Of the solid matter 17·4 lbs. were carbonate of lime or its equivalent of hardening salts. The results are recorded in 100,000 parts. By moving the decimal point one place to the right the above figures express in milligrammes the quantities contained in one kilogramme of the several waters. The fourth column of this table contains the amount of solid matter left on evaporation and desiccation at 120 deg. C.—130 deg. C. (248 deg. F.—266 deg. F.) The whole of the waters were again, as in last month, free from turbidity when drawn from the companies mains.

THE CONTINENTAL GAS AND WATER COMPANY, LIMITED.—On Wednesday, Sept. 5, a summons was heard in chambers, before Mr. Peake, chief clerk to Vice-Chancellor Stuart, asking for time to answer affidavits, and to appoint a provisional liquidator of the company. It was said that the affidavits had only reached the hands of the solicitor that morning, and it was also stated that, if the matter were adjourned, the petitioning creditor would probably be paid off, and liquidation thus rendered unnecessary. The application was granted.

OTTOMAN GAS COMPANY.—A deputation from the Ottoman Gas Company, Limited, consisting of Mr. Horner, one of the directors, and Mr. A. J. King, the secretary, have had an interview with Lord Stanley, at the Foreign Office, on the subject of the company's affairs at Smyrna.

DRAINAGE OF WINCHESTER.—Premiums of £150, £100, and £50, are offered to engineers for plans for the drainage of the city, and for utilizing the sewage.

ARTESIAN WELLS IN ALGERIA.—The *Moniteur de l'Algérie* of the 3rd inst. states that great success is attending the sinking of artesian wells in

# Share List of Metropolitan Gas Companies.

| No. of Shares issued. | Amount per Share. | Name of Company. | Amount paid up per Share. | Div. per Cent. per Annum | Price per Share. |
|---|---|---|---|---|---|
| | £ | | £ s d | £ s d | £ s d |
| 8000 | 10 | Anglo-Romano | 10 0 0 | 9 0 0 | 11 to 13 |
| 5000 | 20 | Bahia (Limited) | 20 0 0 | 4 0 0 | 16 10 0 |
| 1000 | 20 | Do., preference | 20 0 0 | 10 0 0 | 27 10 0 |
| 750 | 20 | Do., do., redeem. | 10 0 0 | 10 0 0 | 12 10 0 |
| 30000 | 5 | Bombay (Limited) | 5 0 0 | £5 intr. | 4¼ to 4½ |
| 10000 | 5 | Do., third issue | 4 0 0 | £5 intr. | 2¾ to 3¼ |
| 10000 | 20 | British, Limited (Norwich, Hull-Sculcoates, Hanley, Tunstall & Shelton (Potteries), Trowbridge, & Holywell.) | 20 0 0 | 10 0 0 | 28 to 28¼ |
| 12000 | 50 | *Chartered* | 50 0 0 | 10 0 0 | 61½ to 62 |
| 6000 | 50 | Do. | 35 0 0 | 10 0 0 | 42 to 42½ |
| 10000 | 20 | *C. of London*, Ash. | 20 0 0 | 10 0 0 | 26 to 28 |
| 10000 | 10 | Do., B shares | 10 0 0 | 4 0 0 | 7 to 7½ |
| 8000 | 10 | Do., new shares | 10 0 0 | 10 0 0 | 12½ to 13½ |
| 25000 | 25 | City of Moscow (L) | 17 10 0 | £7 intr. | 10½ to 12½ |
| 17490 | 25 | Colonial & General *Commercial* | 25 0 0 | 10 0 0 | 33½ to 34 |
| 5000 | 20 | Continental G. & W. | 6 0 0 | 6 0 0 | |
| 2500 | 20 | Continental Union | 20 0 0 | 8 0 0 | 17 to 18 |
| 17500 | 20 | Do. | 10 0 0 | 8 0 0 | 8 to 9 |
| 5827 | 5 | County & Gen. (L) | 5 0 0 | | |
| 2000 | 5 | Do., preference (Pater, Pembroke, Ely, Lea Bridge, Northfleet, Walton, & Ware.) | 5 0 0 | | |
| 5000 | 10 | *Crystal Pal. Dist.* | 10 0 0 | 10 0 0 | 13 to 13¼ |
| 5000 | 10 | Do. | 1 0 0 | 7 0 0 | 1 7 6 |
| 10000 | 10 | Do., preference | 10 0 0 | 6 0 0 | 12½ to 13 |
| 4000 | 50 | *Equitable* | 50 0 0 | 10 0 0 | 70 to 71 |
| 4000 | 25 | Do., new shares | 25 0 0 | 10 0 0 | 36 to 36½ |
| 23406 | 10 | European (Lim.) | 10 0 0 | 10 0 0 | 12½ to 12¾ |
| 12000 | 10 | Do., new shares (Boulogne, Amiens, Rouen, Caen, Havre, & Nantes.) | 5 0 0 | 10 0 0 | 6¾ to 6¾ |
| 20000 | 10 | *Gt. Cent. Gaz Cons.* | 10 0 0 | 10 0 0 | 13 to 13½ |
| 5000 | 10 | Hong Kong (Lim.) | 10 0 0 | | 8 to 10 |
| 26000 | 50 | *Imperial*, old sh. | 50 0 0 | 10 0 0 | 71 to 72 |
| 1300 | 100 | Do., bonds | £100 | 10 0 0 | 180 to 185 |
| 7000 | 25 | Imperial Austrian | 10 0 0 | | |
| 28000 | 50 | *Impl. Continental* (Amsterdam, Berlin, Ghent, Hanover, Lille, Rotterdam, Aix-la-Chapelle, Antwp., Bordeaux, Brussels, Cologne, Frankfort-on-M., Haarlem, Stolberg, Toulouse, & Vienna | 43 15 0 | 16 0 0 | 85 to 85½ |
| | | Impl. Mexican (L.) | | | |
| 3000 | 40 | *Independent* | 40 0 0 | 10 0 0 | 65 to 67 |
| 3000 | 10 | Do. | 10 0 0 | 5 0 0 | 7 to 9 |
| 3000 | 20 | Do. | 12 10 0 | 7 10 0 | 13 to 14 |
| 6886 | 50 | *London* | 50 0 0 | 10 0 0 | 66 to 68 |
| 5519 | 25 | Do., 1st pref. | 25 0 0 | 6 0 0 | 28 to 29 |
| 568 | 50 | Do., 2nd pref. | 50 0 0 | 6 0 0 | |
| 219 | 50 | Do., 3rd pref. | 50 0 0 | 6 0 0 | |
| 18781 | | Do., 1st pref. sk | | 6 0 0 | |
| 11828 | | Do., 2nd pref. sk | | 5 0 0 | |
| 12000 | 5 | Malta & Medit. (L.) | 5 0 0 | 3 0 0 | |
| 30000 | 5 | Oriental, Calcutta | 5 0 0 | 5 0 0 | 5 to 6½ |
| 30000 | 5 | Do., new shares | 1 0 0 | 3 0 0 | ⅔ to 1 |
| 10000 | 5 | Ottoman (Limited) | 5 0 0 | | 2 to 4 |
| 10000 | 10 | Parà (Limited) | 10 0 0 | £6 intr. | 9½ to 9⅝ |
| 27000 | 20 | *Phœnix* | 20 0 0 | 10 0 0 | 27 to 27½ |
| 3600 | 100 | Do., new | 20 0 0 | 7 10 0 | 21½ to 22 |
| 144000 | Sk. | Do. (capit. profits) | | 5 0 0 | 80 0 0 |
| 5000 | 20 | *Ratcliff* | 20 0 0 | 10 0 0 | 26 to 28 |
| | 20 | Rio de Janeiro (L) | 20 0 0 | 10 0 0 | 20½ to 21½ |
| 6959 | 5 | Singapore (Lim.) | 5 0 0 | 3 0 0 | |
| 2000 | 5 | Do., preference | 5 0 0 | 7 10 0 | |
| | | Shanghai | | | |
| 4800 | 50 | *Sth. Metropolitan* | 50 0 0 | 10 0 0 | 75 to 77 |
| 15000 | 10 | *Surrey Consumers* | 10 0 0 | 10 0 0 | 13¾ to 14 |
| 10000 | 10 | Do., new | 5 0 0 | 10 0 0 | 6¼ to 7 |
| 9000 | 50 | United General (Dublin & Limerick) | 50 0 0 | 4 12 0 | 28 to 29 |
| 10000 | 10 | *Victoria Docks* | | | |
| 3000 | 10 | *Wandsworth & Putney* | 10 0 0 | 7 10 0 | 13¼ to 14 |
| 20000 | 10 | Western (Limited) A shares | 10 0 0 | 10 0 0 | 14 to 14½ |
| 10000 | 10 | Do., B shares | 5 0 0 | 10 0 0 | 7 to 7½ |
| 10000 | 10 | Do., C shares | 3 0 0 | 10 0 0 | 5½ to 6 |
| 20000 | 10 | Do., D shares | 1 0 0 | 10 0 0 | 1½ to 2 |
| 8000 | 5 | *West Ham* | 5 0 0 | 7 10 0 | 6 10 0 |
| 6000 | 5 | Do., new shares | 3 0 0 | 7 10 0 | 3 15 0 |
| 551 | 10 | West London Junction (Lim.) | 10 0 0 | 6 0 0 | |
| 520 | 10 | Do., preference | 10 0 0 | 6 0 0 | |

the Great Desert Boring-Works, which were established at El-Gohard, in Hodua, in the circle of Boussada, on the 30th of May last, under the direction of M. Jus, the engineer. Water was found at a depth of 9 mètres 70 centimètres, which rose to a level of 5 mètres below the surface of the soil; at a depth of 90 mètres another sheet of rising water was found; and at 104 mètres the borer fell in with another sheet of rising water, affording a supply of 30 litres per minute; and the works having been continued to 137 mètres, another sheet of water was tapped, giving a supply of 110 litres per minute. Great results are expected from the establishment of the wells.

THE BOLTON WATER-WORKS.—The corporation of Bolton, under a recent Improvement Act granting powers for a large extension of the town water-works, was authorized to purchase 39 acres 7½ perches of land belonging to Mr. P. R. Hoare, of London, banker. In consequence of the large sum required by the owner, which the corporation considered far above its value, the matter was referred to arbitration, Mr. Hunt, of Parliament Street, being appointed assessor. On Saturday the town-clerk received a telegram from the solicitors of Mr. Hunt, making an award of £16,700. The claim made by Mr. Hoare was £37,000, and the value put upon his land by his witnesses was, by Mr. Thomas Slatter, of Bury, £57,837; Mr. R. J. Lawton, Manchester, £69,845; Mr. T. Fisher, Manchester, and Mr. W. Wilson, Manchester. £70,138; while the witnesses for the corporation, Mr. J. C. Blackburne, C.E., valued the land at £9667; Mr. J. Hampson, agent to Lord Wilton, £10,236; Mr. J. Farrer, Bury, £9917; Mr. Ellis Dorning, C.E., Manchester, £11,122; Mr. W. Radford, C.E., Manchester, £9319, which was the lowest valuation. What a mystery is the art of valuation. One valuer goes in for £9319, and another for £70,138 on the same property!

# Price Current.

## CASTINGS.—*Per Ton.*

*Average Weight of Cast-iron Gas-pipes, per Yard.*

| 1¼ in. | 2 in. | 2½ in. | 3 in. | 4 in. | 5 in. | 6 in. | 7 in. | 8 in. | 9 in. | 10 in. | 12 in. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 16 | 21 | 28 | 33 | 51 | 70 | 89 | 107 | 126 | 149 | 177 | 208 lb |

| Retail Prices are 5 to 10 per cent. higher. | London. | Glasgow. | Newcastle | Wales. | Yorkshire, Derbyshire, and Staffordshire. |
|---|---|---|---|---|---|
| | £. s. d. | £. s. d. | £. s. d. | £. s. d. | £. s. d. |
| Pig Iron, No. 1, G.M.B. | 3 15 0 | 2 16 6 | 2 12 6 | 3 10 0 | 4 0 0 |
| 1¼ and 2-inch Socket-pipes | 7 10 0 | 8 0 0 | 6 15 0 | 6 15 0 | 7 10 0 |
| 2½ and 3-inch ditto | 7 0 0 | 6 0 0 | 6 5 0 | 6 10 0 | 7 0 0 |
| 4 and 5-inch ditto | 6 10 0 | 5 10 0 | 5 15 0 | 6 0 0 | 6 10 0 |
| 6 inches and upwards ditto | 6 5 0 | 5 0 0 | 5 10 0 | 5 15 0 | 6 5 0 |
| Retorts, 1st fusion, hot blast | 6 0 0 | — | 5 5 0 | 5 10 0 | 6 0 0 |
| Ditto, 2nd ditto, cold ditto | 7 0 0 | 5 15 0 | 5 15 0 | 6 0 0 | 7 0 0 |
| Tank-plates, ¾ thick and above | 6 10 0 | 5 10 0 | 5 10 0 | 5 15 0 | 6 5 0 |

## WROUGHT-IRON TUBING,

*Subject to 50 per cent. Discount.*

| | ½ in. | ¾ in. | 1 in. | 1¼ in. | 1½ in. | 2 in. |
|---|---|---|---|---|---|---|
| | s. d. | s. d. | s. d. | s. d. | s. d. | s. d. |
| Patent Welded Tubes, from 2 to 12 feet—per foot | 0 4½ | 0 5 | 0 7 | 0 10 | 1 0 | 1 3 |
| Ditto ditto, from 6 inches to 18 inches—each | 0 0 9 | 1 0 | 1 3 | 1 9 | 2 0 | 2 6 |
| Connecting-pieces, or Long Screws | 0 11 | 1 2 | 1 6 | 2 0 | 2 3 | 3 6 |
| Bends, Springs, and Elbows (wrought iron) | 0 8 | 0 10 | 1 1 | 1 6 | 2 0 | 3 0 |
| Tees, wrought or cast | 0 10 | 1 0 | 1 3 | 1 9 | 2 3 | 3 9 |
| Crosses, ditto | 1 2 | 1 6 | 2 0 | 2 6 | 3 0 | 4 6 |
| Iron Cocks | 2 6 | 3 3 | 4 6 | 5 6 | 7 6 | 9 6 |
| Ditto, with brass plug | 4 6 | 5 6 | 7 0 | 10 0 | 13 0 | 16 0 |
| Diminishing Sockets, Caps, Plugs, and Nipples | 0 4 | 0 5 | 0 6 | 0 8 | 0 9 | 1 3 |
| Plain Sockets | 0 3 | 0 4 | 0 5 | 0 7 | 0 8 | 1 0 |
| Syphons, 2-quart | — | 12 0 | 13 0 | 13 6 | 14 0 | 15 0 |

## GAS COALS.—*Per Ton.*

*Newcastle.—Unscreened:—*

| | |
|---|---|
| East Castle, Haswells, Nettlesworth Primrose, and South Pelaw | 7s. 6d. |
| Felling, North Pelton, Redheugh Main, Walker's Primrose, West Wear, and Whitwell Primrose | 7 3 |
| Burnhope, Craghead, Charlaw, Derwent, Edmondsley, Eighton Moor, Hartlepool Pelaw, Holmside, Lambton's Gas, Lanchester Pelaw, Medomsley, Mickley, New Pelaw, Pelaw Main, Ravensworth, South Moor Pelton, South Leverson, Townley Main, Tyne Main, West Pelaw, Wearmouth Hutton, and Witton | 7 6 |
| Peareth, Ravensworth Pelaw, Waldridge, West Garesfield, and West Pelton | 7 9 |
| Brancepeth, Dean's Primrose, New Pelton, Pelton, South Peareth, Stella, Urpeth, Washington Hutton, and West Leverson | 8 0 |
| *Ramsay's Newcastle Cannel* | 20 0 |
| *Wigan Cannel* (at Liverpool) | 17 0 |

*Scotch Cannel:—*

| | |
|---|---|
| Boghead (at Leith) | 30 0 |
| Kirkness, best (at Burntisland) | 28 6 |
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| Bordeaux | 13 0 |
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| Cronstadt | — |
| Copenhagen | 7 15 |
| Genoa | 17 10 |
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WITH

THREE DIAPHRAGMS & ROTARY VALVES,

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UNIVERSALLY USED IN ENGLAND AND THE COLONIES.

The MOST LIBERAL ALLOWANCE for WET GAS-METERS in EXCHANGE for DRY.

WORKS: DIANA PLACE, EUSTON ROAD.

**WANTED, for a small Gas-Work,** an active, steady MAN to make and distribute the gas, lay services, &c. Duties to commence the 9th of October.

Apply to Mr. J. H. HORNSBY, Secretary, Odiham, HANTS.

**WANTED, a Situation as Superintendent** of a Gas-Work, by a thorough practical man just returned from abroad. Would have no objection to go abroad again. Good testimonials from last employers.

Address, J. J. H. B., 26, Bryanston Street, PORTMAN SQUARE.

**WANTED, a First-Class Working** FOREMAN, who thoroughly understands the manufacture of dry gas-meters (Glover's principle). Competent to take the management of a small shop in the country, making about 2000 meters a year; if he could undertake wet meters also would be a recommendation. Enclose testimonials for sobriety, integrity, and ability, and remuneration required, to T. F., care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

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TO GAS COMPANIES.

**MR. ALEXANDER RITCHIE, who** for upwards of Twenty Years acted as Engineer, Manager, and Treasurer of the Greenock Gas-Works, which during his management became one of the best paying works in the kingdom—Mr. R. having cleared upwards of TWENTY-FIVE per cent. upon the capital—has to offer his services to any Gas Company in want of a MANAGER.

Communications addressed to Mr. RITCHIE, at 30, Birslam Street, GREENOCK, will meet with immediate attention.

Greenock, Aug. 24, 1866.

TO GAS COMPANIES AND CONTRACTORS.

**FOR SALE, 4 Purifiers, 9 ft. square** by 2 ft. deep, with hydraulic centre-valve, by-pass valves, and 6-in. connexions, vertical condensers, with by-pass, scrubber, and washer; also a STATION-METER and GOVERNOR. The whole of the above are being removed to make room for larger apparatus, rendered necessary by the rapidly increasing business of the Company.

For further particulars, apply to Mr. A. C. FRASER, Manager, Gas-Works, COLCHESTER.

Gas Company's Office, Colchester,
Aug. 14, 1866.

TO GAS MANAGERS, &c.

**FOR SALE, a "JONES'S PATENT** EXHAUSTER," with 7-inch inlet and outlet pipes, and self-acting hydraulic bye-pass, fitted complete. Has only been a short time in use.

For further particulars apply to JOHN POYNTER and SON, 72, Great Clyde Street, GLASGOW.

**SOUTH METROPOLITAN GAS-LIGHT AND COKE COMPANY.**

NOTICE is hereby given that an ORDINARY MEETING of the PROPRIETORS of this Company will be held at the London Tavern, in the City of London, on MONDAY, the 8th day of October next, at Two o'clock precisely, to receive the Directors Report, and the Accounts of the Company for the half year ended June 30 last, and to declare a Dividend for the same period.—By order,

THOMAS LIVESEY, Secretary.

Old Kent Road, Sept. 14, 1866.

**PHŒNIX GASLIGHT and COKE COMPANY.**

NOTICE is hereby given, that the ADJOURNED HALF-YEARLY GENERAL MEETING of PROPRIETORS, holding previous to Midsummer last £300 paid-up capital and upwards in the said Company, will be held, pursuant to the Act of Incorporation, on WEDNESDAY, the 26th instant, at Twelve for One o'clock, at the Bridge House Hotel, in the Borough of Southwark, for the purpose of declaring a Dividend to Midsummer last; and on other business.

And Notice is hereby further given, that the said Meeting will be made Special for the purpose of making a call of 5 per cent. upon the new stock, payable on the 1st of November next.

By order of the Court of Directors,

CHARLES PRIDDEN, Secretary.

The half year's Dividend, at the same rates as the last, will be payable immediately after the business of the Meeting has terminated; and afterwards at the Company's Office, at Bankside, on Thursday, the 27th instant, from the hour of Twelve till Three, and then will be forwarded by post.

70, Bankside, London, S.E., Sept. 12, 1866.

**COMMERCIAL GAS COMPANY.**—Notice is hereby given that the next ORDINARY MEETING of the Company, will be held at the London Tavern, Bishopsgate Street, in the City of London, on FRIDAY, the 5th day of October next, at Twelve o'clock at Noon, to receive the report of the Directors, and to declare a Dividend to the 30th day of June last.

The Books of the Company will be closed for the Transfer of Shares, from the 20th day of September to the 5th day of October, now next ensuing.

By the Company's Act of Incorporation, Shareholders can inspect the Books of the Company during one fortnight before and one month after the Meeting.

By Order of the Board,

GEORGE JAQUES, Secretary.

Stepney, Sept. 7, 1866.

AMMONIACAL LIQUOR TENDER.

**THE PHŒNIX GASLIGHT & COKE** Company are prepared to receive TENDERS for taking away the AMMONIACAL LIQUOR from all or either of their stations at Bankside, Greenwich, and Vauxhall. The quantity is about 30,000 butts per annum, and will probably increase. The contract to be from year to year. Two sureties in £500 each for the due performance of the contract will be required. The price to be at per butt of 108 imperial gallons.

Specifications may be obtained upon application. Sealed tenders, endorsed "Ammonia Tender," to be left at the Office, 70, Bankside, Southwark, on Wednesday, the 19th instant, at Twelve o'clock.

CHARLES PRIDDEN, Secretary.

London, Sept. 6, 1866.

TO ENGINEERS AND BUILDERS.

**THE Water Committee of the Council** of the Borough of Liverpool are prepared to receive TENDERS for the construction of TWO PUMPING STATIONS in the neighbourhood of Liverpool, consisting of Buildings, Engines, Boilers, and other Works.

Plans may be inspected, and specifications, form of tender, and schedules obtained, at the Water-Works Engineer's Office, Hotham Street, Liverpool, on and after Monday the 3rd of September next, on payment of a deposit of £5 5s., such sum to be returned to all parties tendering. Tracings will be permitted to be taken, such tracings, however, to be returned with the tender.

Tenders to be sent to the Town Hall, Liverpool, addressed to the Chairman of the Water Committee, and endorsed "Tender for Pumping Stations," not later than Noon of Wednesday, the 26th day of September next.

JOSEPH RAYNER, Town-Clerk.

Liverpool, Aug. 29, 1866.

TO GAS COMPANIES AND ENGINEERS.

**TO be Disposed of, by the Falmouth** Gas, Coal, and Coke Company, Limited, a Cast-Iron GASOMETER-TANK, 45 ft. diameter by 14 ft. deep, in excellent condition—estimated weight about 78 tons; together with the bolts and nuts, belt-hoops, &c., belonging thereto. Now lying at Penryn, very convenient for shipment or delivery by railway.

Also with the above, or separately, the Framing and Angle Iron Curbs for a telescope gasholder to suit the above tank. Also the pulleys, chains, guide-wheels, bars, &c.

Application to be made to Mr. W. WARN, Secretary to the Company, Falmouth, Cornwall.

Dated Falmouth, June 23, 1866.

**TO ARCHITECTS, CIVIL ENGINEERS, BUILDERS, &c.**

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These Valves are formed of two cylinders, working one on the other horizontally, having their faces ground perfectly gas-tight.

They are adapted either as central valves, for two, three, or four purifiers—as bye-passes—or as inlet and outlet-valves for gasholders.

They have been fixed in some of the most important Gas-Works in the Kingdom, for more than eight years. Considerably over two hundred of them are now in use, and the most satisfactory reports of their advantages continue to be received. They are simple in construction, and not liable to get out of repair, and if in course of time the faces should leak, they can be easily re-ground and made as tight as ever, without removal from their positions. Each Valve is fitted with an index, which shows to the person in charge of the Works in what direction the gas is passing.

*Frome, January* 20, 1866.

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# CAST-IRON CASED DRY GAS-METER

## (BATHGATE'S PATENT),

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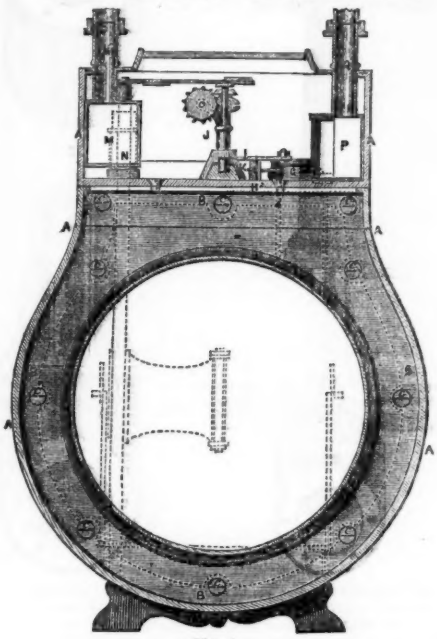

Fig. 1.

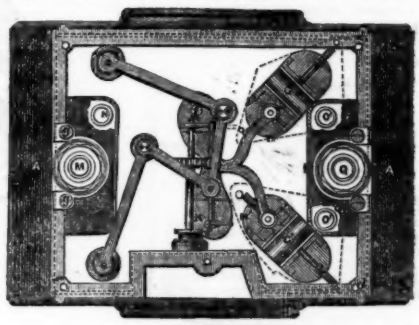

Fig. 2.

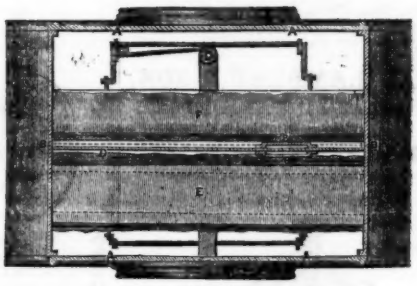

Fig. 3.

[From the *Practical Mechanics Journal*, Dec. 1, 1865.]

The first part of this invention chiefly relates to a new method of construction and arrangement of the parts of dry gas-meters, the cases of which are made by preference in cast iron, whereby great facility is afforded for their being taken in pieces, cleaned, and repaired, and a correct action of the apparatus is insured. In constructing the cases of gas-meters under this invention, they are made in one piece, and without a central division, in contradistinction to those now in use, which arrangement enables the diaphragms, when necessary, to be lifted out with little trouble. The one diaphragm-back, made of iron, is substituted in lieu of, and answers the purpose of two, at the same time supplying the place of, and fulfilling the purpose of a central division. This back, on which are fixed the two diaphragms, is fixed by screws to holders projecting from the centre of the case. The chief advantage derived from this arrangement is, that the two diaphragms can be taken out together.

The second part of this invention relates to a peculiar arrangement of the valves, which are also easily taken out, each valve being worked upon a separate plate, to which (plates) are also connected the inlets to the diaphragms and exit-tubes. By removing the screws by which the port-plates are connected to the valve-plate, these last-mentioned parts are removed. In the valve-plate are two holes—viz., one from each of the exit-tubes, over which is placed a box, which contains the measured gas from these tubes. This box is fixed to the flange of the top box of the meter by screws. On the inside of this box, through which the measured gas passes, are two vertical tubes of sufficient depth, that, in the event of condensation taking place, they prevent the condensed gas from getting into and interfering with the action of the valves. Another important feature of dry gas-meters constructed under this invention, is the use of a double flange on the top of the case, by means of which the valve-plate and top box connected to it are attached to the meter-case. On the centre of the valve-plate, and contained within the top box, there is fixed by screws, studs, or otherwise, a small plate holding the step-crank, and crank-support, tangent-catch, and support for index-spindle; the whole of the latter parts may be removed by taking out the screws by which the plate containing them is fixed to the valve-plate.

Fig. 1 of the engravings is a transverse section, at the centre of fig. 2, of the improved dry gas-meter. Fig. 2 is a plan of the upper part of the meter with the cover removed, showing the arrangement and position of the gear for actuating the slide-valves and the gas-measuring boxes—fig. 3 being a sectional plan through the meter-case.

In the engravings, the case of the meter is marked A, and, projecting from the centre of its side, top, and bottom, is the flange, B, to which, by means of the screws, *c c*, the one diaphragm-back, D, is fastened; this diaphragm-back, as previously mentioned, is substituted in lieu of, and answers the purpose of two, as ordinarily used; it at the same time substitutes a central division, which it has been usual to employ in dry gas-meters constructed previously to this invention. The two diaphragms, E and F, more particularly seen in plan, fig. 3, are attached to this one diaphragm-back in the usual manner, so that, the two being fixed together, their combination with the diaphragm-back forms one separate and distinct portion of the apparatus, the whole of which is readily removed by the withdrawal of the screws, *c c*.

The peculiar valve arrangement embodied under this invention is more particularly seen at fig. 2, in which figure, as well as in fig. 1, the valves themselves are marked $G^1$ and $G^2$—$G^2$ only being seen at fig. 1. The plates, $H^1$ and $H^2$, upon which the valves, $G^1$ and $G^2$, respectively work, are attached to the top plate of the meter-case by screws, *d*, upon withdrawing which, the valve-plates and their attached parts are easily removed. The edges of the ports are made to project some distance above the lower part or flange, by which the junction with the meter-case is effected; and openings are left in the top plate of the case, through which the projecting portions containing the ports pass. The valves themselves are of the ordinary slide class, and are actuated over the ports by means of connecting-rods, to which motion is imparted from the central crank-shaft, J, this shaft, from which the index-gearing is also driven, being actuated by means of other gearing from the diaphragms in the ordinary manner, and which, being similar to the mechanical movement usually employed in gas-meters of this kind, need not be more particularly mentioned, the same being intelligible to an expert, by reference to the engravings. The chief improvement connected with the valve arrangement being, that by removing the frame, K, which carries the central crank-shaft, L, and step-bearing for the same, the whole of the gearing, together with the two valve connecting-rods, I, $I^1$, are brought away together, thus leaving the valves themselves perfectly free for removal. The crank-shaft framing, K, is removed by withdrawing the screws, *f f*, by which it is connected to the top plate forming the meter-case. The boxes, by means of which the gas enters and passes from the meter, are arranged as follows:—The entrance-box is marked M in figs. 1 and 2, the gas entering from the pipe, $M^1$; it will be observed that the box, M, is closed at the bottom, and that surrounding a hole formed therein, the pipe or tube, N, is fixed with a tight joint. The upper end of the pipe, N, does not quite reach the top of the inside of the box, M; by this means, as the gas enters the box, it cannot escape therefrom by any other way than through the pipe, N, so that, if any moisture in the gas, or other condensable matter, should enter the box, it would remain therein until the deposited matter became level with the top of the tube, N; thus, nothing but the gas itself enters the meter, and the facility afforded for removing the box, M, enables it to be occasionally withdrawn, so that any condensible matter which may have collected therein is taken out. The box is fixed by means of screws, *g g*, to the flange of the top box of the meter, by withdrawing which it is easily removed.

The box through which the gas escapes is differently constructed, and marked P, in figs. 1 and 2; it is fixed to the top plate in the same manner as the entrance-box previously described. Within it are two tubes, O $O^1$, more particularly seen in fig. 2, part of the top of the box being cut away to render them visible; each one of these tubes is connected to the ducts through which the gas escapes after having been measured, and passes thence through the exit tube, Q, to be burned.

What is considered to be a very important point in connexion with this part of the invention is the mode in which the passage-valves, by which the gas enters and escapes from the diaphragms, are constructed thus;—two oblong openings are formed, one in each ring, to which the leather is jointed on each side of the diaphragm-back; from these, two ducts of oblong or other suitable form extend, and which are dotted in fig. 1. These upper portions are turned off at right angles below the two tubes of the escape or exit box, P, and proper recess-joints are attached thereto for the reception of that part of the ducts which leads to the slide-valves, through the cavities in which the gas in escaping from the diaphragms as they are alternately pressed in, passes to one or other of the two tubes into the escape-box, P, while the gas from the portions of the meter outside the diaphragms escapes through the open part into the cavity of the valves, and thence through the centre part into the escape-box by the same tubes.

## EDMUND SMITH,

GRASBROOK, HAMBURG,

would respectfully call the attention of engineers and managers of gas-works to his Newly Improved GAS-METER, patented 1862 in England, and the principal parts of the Continent.

Price-lists and tenders for gas-meters, experimental station-meters, experimental holders, governors, purifiers, gasholders, pressure-gauges, gas and water fittings, &c., are forwarded on application.

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**HYDRATED OXIDE of IRON**

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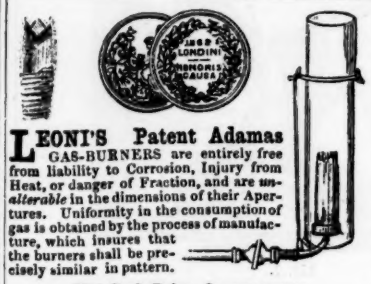

**LEONI'S Patent Adamas** GAS-BURNERS are entirely free from liability to Corrosion, Injury from Heat, or danger of Fraction, and are *unalterable* in the dimensions of their Apertures. Uniformity in the consumption of gas is obtained by the process of manufacture, which insures that the burners shall be precisely similar in pattern.

**Net Cash Price, 8s. per gross.**

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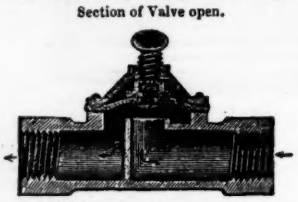
SHORT STREET, LAMBETH, LONDON.

**CARTER'S SAFETY GAS-VALVES,**

Made to suit every Description of Fittings.

Section of Valve open.



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**GAS-METER MANUFACTURERS**

(Stamped according to the Sale of Gas Act).

**STATION-METERS ANY SIZE.**

PHOTOMETERS, EXPERIMENTAL METERS,

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*Price List on application.*

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**GARSIDE'S Registered Tube-Vice** and improved Main Drilling Clips may be had from the maker.

For drawings and prices apply to SAMUEL GARSIDE, Gate Field Iron-Works, ASHTON-UNDER-LYNE.

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TO INVENTORS AND PATENTEES.

**MR. W. H. BENNETT, having had** considerable experience in matters connected with Gas, Water, and Sanitary Improvement, begs to say that he continues to assist Inventors in the perfection of their designs, and to obtain for them PROVISIONAL PROTECTION, whereby their invention may be secured for Six Months; or LETTERS PATENT, which are granted for Fourteen Years.

Patents completed, or proceeded with at any stage, thereby rendering it unnecessary for persons resident in the country to visit London.

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Information as to cost, &c., supplied gratuitously upon application to the advertiser, 42, Parliament Street, WESTMINSTER. [Office of the JOURNAL OF GAS LIGHTING, &c.]

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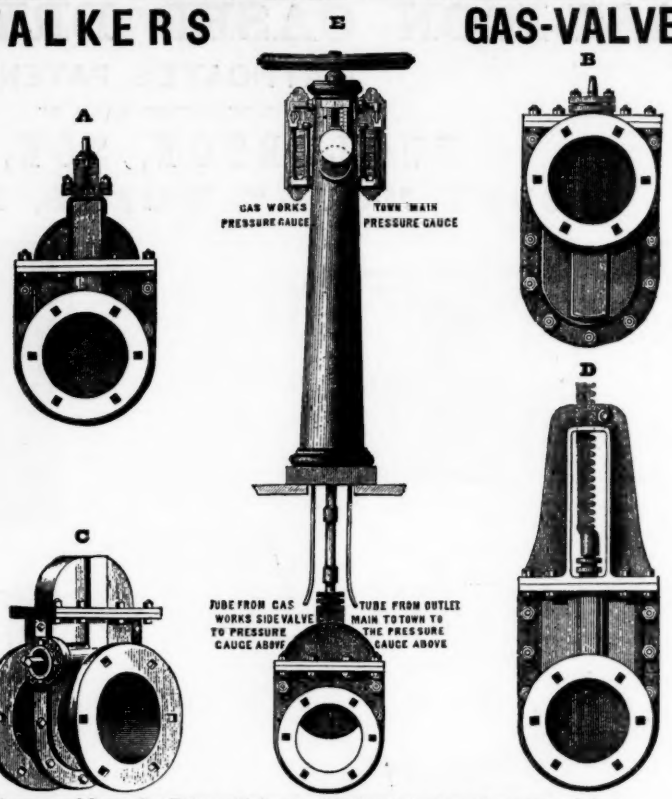
## WALKERS GAS-VALVES.




**A**—Aboveground Screw Gas-Valve, with improved Indicator, to show when open and shut.
**B**—Undergound Screw Gas-Valve, for shallow Street-Mains, made with or without an Indicator.
**C**—Internal Rack-Valve, with wrought-iron Pinions and machine-cut Teeth.
**D**—Ordinary Rack and Pinion-Valve, with strong, undamageable Racks and Pinions—made as shown, or boxed up for Street-Mains.
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## LEE MOOR PORCELAIN FIRE-BRICKS,

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Sole Manufacturer of **PADDON'S PATENT STREET-LAMP REGULATORS,** for insuring any required consumption. These Regulators are in general and increasing use, and references can be given to Gas Companies who use them for every Lamp.

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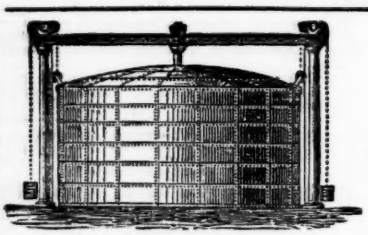

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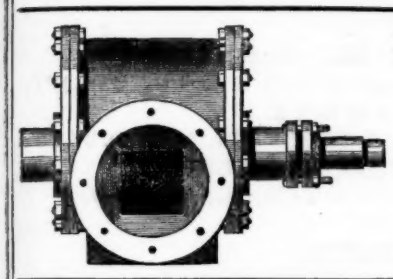

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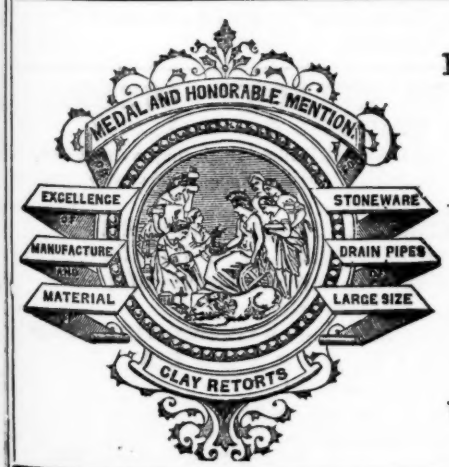


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